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THE JOURNAL OF RESOURCE RECOVERY

National Center for Resource Recovery, Inc.

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Resource Recovery:
An Investment Opportunity for the '80s

By ROBERT H. ALDRICH
and
RENÉ ROFÉ

Solid waste disposal historically has been the responsibility of local government. While this responsibility has been sometimes delegated to or assumed by private industry, local municipalities continue to be faced with problems of economically and environmentally disposing of solid waste in their jurisdictions.

The rising costs of landfill disposal, the recognition of the increasing value of products and energy recovered from the waste stream, and attractive federal incentives have fostered the development of a new business—resource recovery. The potential for profits has attracted the attention of both industry and investors.

The emergence of the "resource recovery industry" in the last decade was slowed down by technical and economic difficulties, leaving the industry with a somewhat tarnished image and making it difficult to attract the required capital—equity and/or debt. On the positive side, however, we believe there will be a resurgence of investor interest in the area in the 1980's based on these factors:

- Resource recovery technology is developing to the point where systems are proving to be reliable and economical.
- Prices of recovered energy and material will rise more rapidly than other economic indices, making resource recovery competitive with rising landfill costs.
- Raising capital using public debt will become increasingly difficult, forcing communities to seek private sector financing.
- The federal government, through direct assistance and indirect tax benefits, will encourage the private sector to invest in resource recovery facilities; and municipalities and industries will learn what risks are appropriate for them to assume in projects, and the time of procurement and negotiation will shorten.

Robert H. Aldrich and René Rofé are senior consultant and vice president, respectively, of Blyth Eastman Paine Webber, Inc.

Resource Recovery as a Business

The resource recovery industry is the progeny of two ancient businesses, one public and one private. It combines the public need to reduce volume and dispose of solid waste with the scavenging of valuable materials in the waste stream. The new concept in the resource recovery business is to process unsegregated municipal waste and to mechanically extract and recover salable products and energy. The primary functions are to provide reliable, environmentally acceptable, low cost disposal service; reduce the quantity of waste being disposed of in landfills; and economically recover the valuable resources contained in the waste stream.

Resource recovery has all the basic elements and functions of a manufacturing business: raw materials supply (solid waste), manufacturing facility (resource recovery plant), marketing, capital financing, operating and maintenance expenses, "profit and loss" requirements, and waste disposal.

The evolving resource recovery industry is unique, requiring both public and private sector expertise and functions. In response to this, the private industry and the public sector are working together to develop this industry—evolving new relationships in the areas of procurement, finance, construction, operation, risk sharing, and management. As a business, resource recovery has clear profit-making potential and financial and operating risks, and these factors distinguish it from other public works projects. The community service aspect, with its requirement to perform a basic public function and its requirement for community economic support, distinguish it from the normal business function.

A critical factor to be dealt with in considering the development of a resource recovery facility is the availability of raw material. Without an adequate supply of solid waste, any such facility will be economically, as well as practically, unproductive.

To the extent that a municipality itself collects the solid waste, the municipality controls the source of supply. To the extent that private haulers collect all or part of the solid waste in a given area, it may be useful, if not imperative, to enter into long-term contracts with the private haulers. This approach is not without problems, as it is premised upon the haulers and the municipality realizing agreement on the terms of the arrangement. In addition, where there are a great many private haulers in the area, the municipality may be forced to negotiate with them individually.

Resource recovery technology is developing to the point where systems are proving to be reliable and economical.

An alternative or complement to contracting with the private haulers is the enactment of a comprehensive plan, including local legislation, which would ensure, through licensing and other regulatory schemes, that no other facility, such as a landfill, may compete with the solid waste disposal plant for waste materials, and that the processible waste is delivered to the resource recovery plant.

Manufacturing Facility

There are a number of technologies in existence and being developed which

(Debt Service) + (Operating and Maintenance Costs) + (Operators Profit) = (Disposal Fee) + (Recovered Energy and Materials Income)

have the capability of separating solid waste into salable materials and energy. The choice of the technology is dependent upon the size and quality of the waste stream, the available markets for the products, the requirement for reliability of processing and/or energy delivery, and the economics.

Although resource recovery had been practiced in Europe for more than two decades, the technology is still considered to be in the development stage, and existing plants throughout the United States have experienced varying degrees of difficulty in reaching full commercial operation. The technology is being developed by the private sector—equipment and systems suppliers.

The products from a resource recovery facility potentially include: ferrous and nonferrous metals, glass, compost, paper and energy. The high value of the energy and the relative reliability of the energy market generally are the controlling factors in developing a market plan. **Table I** is our estimate of market prices for the alternative products and the unit value of those products per input ton of municipal solid waste (MSW).

A resource recovery facility generally is a major investment. Depending on the process, scale and recovered product mix, a facility can cost from $10,000 to $100,000 per daily ton of waste processing capacity. Operating and maintenance costs of resource recovery facilities are substantial, due primarily to the requirement to reliably process a heterogeneous and variable raw material. Maintenance of these facilities has been a major cost factor due to the corrosive and erosive nature of MSW.

A private operator under an operating agreement or as a full-service operator will expect to make a reasonable profit for the services provided and the risks assumed, and this is generally factored into the cost of operating and maintenance.

"Profit and Loss" Requirements

Fundamental resource recovery economics can be expressed by the following equation:

(Debt Service) + (Operating and Maintenance Costs) + (Operators Profit) = (Disposal Fee) + (Recovered Energy and Materials Income)

The basis for analyzing viability of a resource recovery project—whether from the point of view of the investor, the municipality, or private sector participant—is the economic projections of the factors of this equation, and the reliability and accuracies of the estimates. While the municipalities and/or the private sector may provide certain economic guarantees or covenants, potential investors must be satisfied that the projections of all revenues are sufficient to provide payment of debt service and operating and maintenance costs. At the same time, the municipality must assure itself that its disposal fees will be kept within an acceptable range. Events which may cause projections of any factor in the above equation to fail to meet expectations constitute the elements of risk in resource recovery.

A resource recovery facility does not totally convert all of the waste into recyclable materials. Generally a resource recovery facility will generate some 15-20 percent by weight of waste which must be landfilled. In addition, the facility has periods of outage during which time the raw refuse must be bypassed to a landfill. Therefore, it is imperative to the operation and economic success of a project that adequate landfill be made available to provide for the anticipated and unanticipated needs of a resource recovery facility.

Economics of Resource Recovery

Resource recovery must compete with alternative forms of disposal available to a community—generally landfill. Short-term economic comparison of resource recovery vs. existing landfill options is not an adequate or complete measurement tool. Other key factors to be considered include:

- Long-term costs and availability of acceptable sanitary landfills;
- Life-cycle economic analyses of resource recovery, taking into account escalating energy values;
- Use of energy produced by the resource recovery facility to attract or maintain industry or commerce—or to provide low cost, reliable energy to the community; and
- Policy decisions at the federal, state and local levels to reduce dependency on landfills as well as to reduce the need for imported energy.

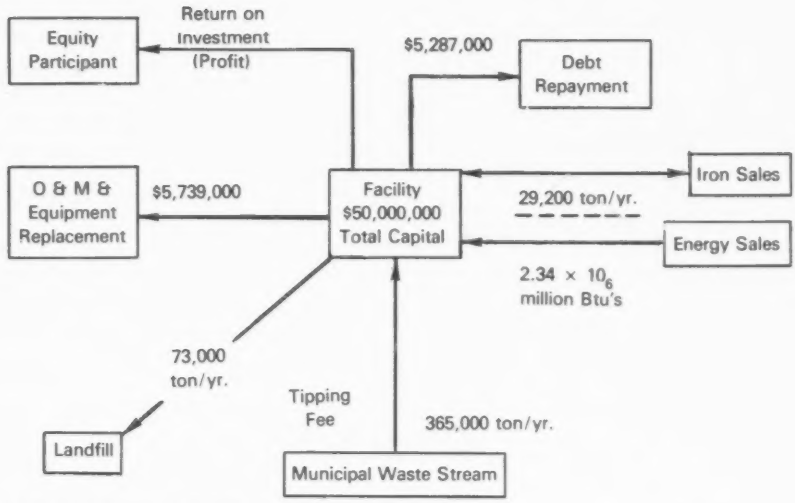
The true cost of landfilling has been frequently understated due to the diffi-

Table I
Market Value for Products of Resource Recovery

Recovered Resource	(1979 value) lbs/ton	$/lb	$/ton MSW
Iron	160	.01-.02	1.60-3.20
Aluminum	16	.15-.20	2.40-3.20
Paper (recovered for sale)	100	.01-.03	1.00-3.00
Glass	150	0-.01	0-1.50

Energy	Million Btu/ton MSW	$/Million Btu	$/ton MSW
Refuse-derived fuel	5.5-9.3	1.00-2.00	5.50-18.60
Steam	6.0-7.0	3.00-6.00	18.00-42.00
Electricity	530 kw hr/ton MSW	.01-.05 kw hr	5.30-26.50

Table II
First Year Operation



First Year Economics and Escalation Assumptions

1. Total Capital Cost: $50,000,000
2. Annual Debt Service @ 8.5% for 20 years: $5,287,000
3. Operating and Maintenance (O & M) and Equipment Reserve: $3,500,000 escalated @ 6% per year
4. Iron Sales: 8% recovered @ $30/ton: no escalation
5. Energy Sales: 6.4 million Btu/ton @ $3.50/mm Btu: escalated @ 8% per year
6. Landfill: 20% of MSW @ $8/ton: escalated @ 9% per year
7. Profit and Excess Funds: assumed none
8. Waste Stream: 365,000/yr: increasing @ 2% per year
9. Tipping Fee: annually calculated

culty in evaluating the future costs of developing new sites, upgrading existing sites, and abandoning old sites with appropriate long-term care facilities. Useful life of existing landfills has also been difficult to assess, particularly as new federal and state regulations are promulgated.

When comparing the alternative of landfill vs. resource recovery, the evaluator must be able to take all existing and future costs into account for a life-cycle comparison. Even short-term economic comparisons are not totally valid unless "all" costs—*i.e.*, transportation, equipment repair, road maintenance, etc.—are properly accounted for.

Resource recovery is a business and, as such, can be evaluated by analyzing costs vs. income over the anticipated useful life of the plant and equipment.

Table II is a simplified flow chart of a "typical" resource recovery facility.

A municipality can develop economic models of resource recovery and landfill alternatives. The precision of the models is dependent upon the accuracy and detail of the input data and the ability to forecast economic trends. (Note: communities often spend an inordinate amount of time and money in early development of accurate capital and operating and maintenance costs, while developing less precise projections on available waste supply, market values of recovered resources, and impact on the project of alternative terms of financing.)

Risks

The key to the viability of resource recovery is the ability to identify all the risks associated with a project and to allocate the risks to the project participants on a fair and equitable basis.

It is important to recognize that lenders, particularly purchasers of municipal bonds, are not project risk-takers. They are generally large institutions or individuals seeking fixed income from their investments in tax-exempt bonds. These lenders demand protection against all risks with the exception of changing financial market conditions—requiring assurance that they will be repaid from (1) project revenues, (2) project participants (*i.e.*, the municipality or owner/operator), and (3) proceeds from insurance in the event of a failure which is insurable.

The party assuming full ownership and operating responsibilities can assume all the risks associated with the project, passing off certain construction risks to the contractor and equipment suppliers. In this case, the owner would guarantee the debt using its general credit and/or its ability to generate the revenues to the project through special assessments, tipping fees, and sales of recyclables. In this case, the lender would look to the owner's general credit standing and/or to its ability and capability to generate revenues, be it a public or private owner.

In most cases, however, resource recovery projects are being developed on the concept that the project will be self-sustaining, and that the required tipping fees and other revenues will remain reasonable and adequate to maintain a constant level of service and to promptly and fully repay the debt. In this case, the lender and the owner have an equal interest in analyzing the risks which impact upon the revenues of a resource recovery project. Such risks include *capital costs; operating and maintenance costs; recovered energy and materials income;* and *disposal fee income.*

Financing Alternatives

A key element to the successful implementation of a resource recovery project is the development of a financing plan and structure. The financing program should be structured to meet the overall objectives of the participants, and designed to provide adequate funding for the planning, construction and operation of the project.

Investment Opportunity

Important considerations in developing a financing strategy are:

- The availability of adequate capital to finance the construction and operation of the facility;
- The cost of capital, which is a function of interest rate and terms of the debt, the utilization of private equity and tax benefits of private ownership, and the availability of federal and state financial assistance;
- The allocation of financial risks among the participating parties in the project;
- The mechanism of sharing the economic benefits derived from the sale of recovered material and energy; and
- The ultimate ownership and control of the resource recovery facility.

There are some significant tax benefits for private ownership of resource recovery facilities.

Resource recovery is unique in the field of public finance in the number and diversity of financing options which can be utilized. It is important to the success of a resource recovery project that municipalities be aware early in the process of these options and of their impact on the development and implementation. Sources of capital for resource recovery projects include (1) federal assistance programs, (2) public financing alternatives, and (3) private financing alternatives.

Federal Assistance Programs

The federal government has developed and is implementing a number of programs to provide direct and indirect assistance to communities and industries for planning and implementing solid waste disposal and resource recovery projects.

Direct federal grants for solid waste disposal and resource recovery projects will not approach the scale of the federal grant program for waste water treatment projects. However, meaningful direct and indirect assistance is being made available to public bodies and private persons for planning, developing and implementing resource recovery projects.

Congress, cognizant of the desirability of both environmentally disposing of solid waste and recovering and recycling valuable materials and energy, has passed legislation which provides substantial indirect federal support to resource recovery projects.

There are some significant tax benefits for private ownership of resource recovery facilities. They include:

Industrial revenue bond financing, where a private person can utilize tax-exempt bonds (industrial revenue bonds) to finance resource recovery facilities at substantial savings in interest rate;

Investment tax credit and energy tax credit, where taxpayers who own a facility that recovers energy can take advantage of a 10 percent investment tax credit on new facilities (a non-refundable direct deduction from federal tax) and a 10 percent energy tax credit (proportionally less if financed using tax-exempt debt);

Accelerated depreciation, where private owners can accelerate depreciation of resource recovery facilities for tax purposes (current guidelines call for a 8-to-10 year depreciable life on eligible facilities); and

Deduction for interest or rental costs, where a private owner is allowed a tax deduction for interest paid on debt, or, if the project is leased, a deduction for the full rental payment.

Public Utilities Regulatory Policy Act

The Federal Energy Regulatory Commission (FERC) has issued regulations which provide that (1) qualifying facilities which produce and sell electric energy are exempt from state and federal regulations as an electric utility; (2) utilities must purchase electricity from the qualifying facility at a fair price (to be developed by state regulatory agencies, but including both cost elements of fuel replacement and capital offset); and (3) utilities must provide qualifying facilities which produce standby electric capacity at a reasonable price.

The Public Utilities Regulatory Policy Act will provide to many resource recovery projects a reliable, long-term market for electricity at an attractive price. To qualify, a resource recovery facility must have a capacity of less than 30 megawatts, or be designated a cogenerating facility. State agencies have until March 1981 to comply with the regulations developed under the Act. States that have completed initial studies show that utilities will be required to pay substantially higher prices for electricity than their existing average cost. Also, federal agencies are encouraged to purchase recycled metal and energy from resource recovery facilities. In certain instances, there are incentives built into the purchasing agreements as well. Each federal agency has established its own policies and issued directives.

Public Financing Alternatives

Three public financing alternatives are *general obligation bonds, revenue bonds,* and *industrial development bonds.*

General obligation bonds, representing an unconditional guarantee, are backed by the full faith and credit of the issuing public body. These bonds, considered by purchasers to be the strongest debt instrument, tend to bear a lower interest cost when compared with alternative financings by virtue of the unconditional nature of the obligation of the issuing body. Naturally, the credit rating of the issuing body is the primary determinant in the salability and price of the debt instrument.

Municipalities, by statute, are required to obtain voter approval prior to issuing general obligation bonds. Factors for considering the use of such include: existing credit rating of the issuing body; impact of the financing on the credit rating of the issuing body; voter resistance to public bodies assuming the total risk; and debt-ceiling or other limitation that may be imposed on a particular public body.

The risk to a municipality arising out of the use of general obligation bonds may be mitigated to some extent by contracts from process vendors and energy users providing certain performance guarantees and financial backup commitments.

Three public financing alternatives are general obligation bonds, revenue bonds, and industrial development bonds.

Revenue bonds are payable solely from the revenue derived from the project tolls, user fees, rents, etc., or other facilities owned by the public body.

If bonds payable primarily from revenues of a particular facility are also secured by the full faith and credit of the public body, they are considered general obligation bonds. Special tax bonds, a form of revenue bonds, are payable from the proceeds of a special tax which is assessed for the specific service provided (*e.g.*, water district bonds).

General obligation bonds can be used for a portion of the project as a mechanism of making a public contribution to a project, or as a method of providing additional security to other forms of financing by providing additional available funding for specific cases of shortfalls.

Industrial revenue bonds can be issued by public benefit corporations formed by special legislation to facilitate financing of projects deemed to be essential for promoting economic development (or some other public service) within the geographical boundary of the corporation. Solid waste disposal and resource recovery facilities are included within this definition for a number of such corporations. Under this particular form of financing, the project financed is leased, or the bond proceeds are loaned to a private corporation.

Private Financing—Tax Consequences

Private industry can play a major role in the development of resource recovery. Municipalities faced with debt limits and unwilling to assume full ownership risks have transferred responsibility to the private sector. In addition, the federal and state tax benefits of private ownership are extremely attractive and, when combined with the use of industrial development bond financing, make an attractive alternative.

Leveraged leasing is a form of project financing that involves the leveraging of an equity investor's funds and the pass-through to the user/lessee—in the form of lower lease rentals—of the tax benefits inherent in the ownership of the project. An economic prerequisite usually is that the tax benefits of ownership can be utilized more effectively by the equity investor (as owner/lessor) than by the user/lessee. Principal among such tax benefits are the investment tax credits and deductions for accelerated depreciation and interest.

In the event the user/lessee is able to take full advantage of the tax benefits of ownership, there may be little economic justification for engaging in leveraged leasing. The determination of whether or not the user/lessee can fully utilize the tax benefits requires a careful review of its estimated tax liabilities over the period during which these tax benefits would be available.

In leveraged leasing, equity investors acquire the project to be leased prior to its in-service date for tax purposes through a specially-created ownership trust or partnership. Their investment must be at least 20 percent of the cost of the project. The balance of the cost of the project is obtained from the issuance by the trust or partnership of its long-term obligations. The debt financing is without recourse to the equity investors and is secured only by an interest in the project assets and an assignment of the lease. The equity participants' return on investment is derived from (a) the net cash flow available from lease rentals in excess of debt service, (b) the tax benefits of ownership and (c) the residual value of the project.

Leveraged leasing can produce significant savings in financing costs whenever the user cannot fully utilize the tax benefits associated with the project. This may occur because of substantial investment tax credits or reduced tax liabilities resulting from special deductions or net operating loss carry forwards. When this situation exists, the lessee may gain more from the reduction in financing costs than will be lost through passing the tax benefits through to the lessor.

The Crude Oil Windfall Profit Tax Act, signed by President Carter in April 1980, has certain provisions that significantly effect resource recovery financing in the private sector:

- Section 103(b)(4)E of The Internal Revenue Code of 1954, as amended, has been expanded to include a new section 103(g) which defines specific solid waste facilities which qualify for industrial development bond financing; *i.e.* a "qualified steam generating facility" and a "qualified alcohol producing facility." There are limitations to the use of 103(g), particularly the requirement for an owner to also be the operator of the facility.
- Section 241(b) of this legislation permits sale of steam and electricity to a federal facility under certain conditions, primarily that the owner must be a public body and that operating agreements with the private sector be limited to one-year contracts.
- In addition to provisions expanding the use of tax-exempt financing for the construction of certain energy related facilities, the Act expands the definition of certain kinds of property already eligible for energy credits.

Interest paid on indebtedness issued by municipalities is exempt from federal taxation with respect to industrial development bonds. However, the exemption will apply only where substantially all of the proceeds of the bonds are used to finance particular activities, including solid waste disposal facilities, or where the bonds are part of an exempt small issue. Internal Revenue Service regulations define the term "solid waste disposal facility" as property used for the collection, storage, treatment, utilization, processing or final disposal of property which is useless and has no market value at the place where it is located. The regulations also provide for stringent "timing rules" under which certain official actions must be taken before the commencement of construction and require that the bonds must be issued within one year after the facility is placed in service. It should be noted that regardless of whether the interest paid on the bonds qualifies for the federal exemption, an exemption from state taxation should be available, provided the issue is authorized by the stat-

ute exempting the interest from taxation.

Cost Comparisons

In determining the optimum method for financing the capital requirements, the factors which must be taken into account include:

- The terms of the proposed debt structure (interest rate and repayment schedule);
- The availability and cost of equity capital;
- The availability of tax benefits to private owners;
- The availability and restrictions on the use of federal assistance programs (loan guarantees, planning grants, construction grants, etc.);
- The use of state funds, and the restrictions on the project's financing by using such funds; and
- The costs associated with developing and implementing a financing program (underwriting costs, legal fees, taxes, insurance, etc.).

In addition to all these considerations, the financing program must be integrated into the total project development and meet the goals and objectives of the participants—and properly apportion the risks and rewards among the parties.

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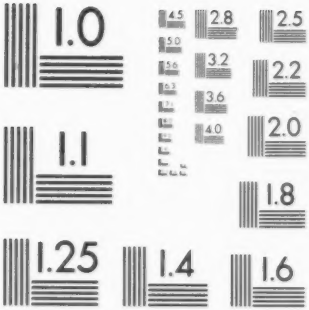

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THE JOURNAL OF RESOURCE RECOVERY

March 1981 Volume 11, Number 1

2 Comment

Dr. Rocco A. Petrone
NCRR President

3 Appropriate Technology for Resource Recovery

Since the early 1970s, there has been a debate as to the best resource recovery approach for a given application: "low-technology" source separation and recycling, or "high-technology" processing for mechanized materials and/or energy recovery. Author Stephen A. Hill analyzes the two approaches as alternative and complementary options for a community considering resource recovery.

8 . . . in resource recovery

9 Baltimore County's Resource Recovery Facility

The Baltimore County, Md., resource recovery plant, operating since 1976 to shred the county's refuse and recover ferrous metals, is producing refuse-derived fuel for tests and is preparing to recover a glass product. This article describes the facility's history and operations.

15 Resource Recovery Activities

This semiannual listing updates information on resource recovery facilities around the country.

Comment

Dr. Rocco A. Petrone
NCRR President

In the national drive for economy (to which we all can subscribe) and the new Administration's implementation of this needed thrust, there is the to-be-expected consternation here in Washington about the impact of this "economizing" and "reducing." Take one rather small area, that of federal support of resource recovery, or as it has more recently been dubbed, energy from municipal waste.

Why should there be any federal support at all of either resource recovery research, demonstration and development (RD&D), or of local initiatives to get projects underway? Briefly, the answer is that recovering energy and recyclables from refuse serves several stated national goals and priorities: seeking new energy sources, conserving resources and facilitating environmental disposal of discards.

It was the latter goal that stimulated national interest in resource recovery 10 years ago. But it was the need for alternate sources of energy that provided the stimulus for the first federal funding of any significance. With the passage of the Energy Security Act last year, $220 million was appropriated, much of it to provide price support loans to assist local projects by leveling out early costs over the lifetime of projects. This is a payback program. Also to be increased was RD&D, to make needed advances in the technology in order to commercialize the processes. Specifically appropriated for R&D was $10.9 million.

It now appears that the Administration intends to recommend to Congress that the $220 million appropriation under the Energy Security Act be deleted entirely, and that the $10.9 million appropriation be reduced to $5.7 million.

In Congressional hearings on FY 1982 Department of Energy (DOE) authorization on the alcohol fuels and energy from municipal waste programs, Rep. Richard Ottinger (D-N.Y.) stated: "I believe it is important to emphasize that the Administration is not just proposing that no additional funds be appropriated for these programs, but that funds already appropriated be withdrawn." Mr. Ottinger went on to say that these programs had been considered essential in obtaining passage of the Energy Security Act because the utilization of biomass energy (of which municipal refuse is a part) "not only offered the potential for a near-term substitute for imported crude oil, but also provided an environmentally benign alternative to synthetic fuels."

From the standpoint of enlightened self-interest, this cutback clearly affects our overall goal of advancing recovery and recycling and, more directly, NCRR operating programs since much of our R&D work is funded by DOE. On one hand, we are devoted to helping advance the implementation and understanding of any type of system for recovery and reuse of residuals as long as that system meets desired economic and environmental goals. On the other hand, we are directly involved in performing a variety of research and development projects for DOE, aimed at finding and sharing answers and at furthering the state of the art. The important reasons for continued R&D were outlined by NCRR's Dr. James Abert when he was invited to testify before Mr. Ottinger's hearing in late February.

In a broader, more important sense, the nation will suffer by not quickly realizing the energy benefits from solid waste. Because the rationale for it is compelling, resource recovery will prevail, although at what might seem a ponderous pace. Indeed, every year's delay is a year lost.

Energy from municipal waste appears to be cost-competitive and in relative terms should stand high as a priority candidate for federal support.

A review of the listing of current projects in this *NCRR Bulletin* issue reveals that by the end of the year, 43 facilities will be at some stage of processing refuse for energy and disposal. This indicates a start has been made. And there are more than 100 communities where resource recovery is being considered. In my view, it is unlikely that many can soon move forward without some assistance in terms of risk-taking at the national level or national actions to change relative prices as seen at the local level.

The reality of it all is that while the need to economize will not go away, neither will the problems of municipal solid waste and escalating costs of energy. In considering how to best to spend federal dollars, it seems to me that the national interest would best be served by recognizing and then assigning a high priority to the waste disposal and energy-deriving values of resource recovery.

Rocco A. Petrone

Appropriate Technology For Resource Recovery

'Low-Technology' Recycling or 'High-Technology' Processing?

By STEPHEN A. HILL

Resource recovery's emergence in the 1970s as an alternative to traditional solid waste disposal methods spurred a debate over "appropriate" technology. The discussion has centered on national issues such as waste disposal, resource utilization and local self-determination. But what are the implications of this debate for local government, which is ultimately responsible for the collection and disposal of municipal solid waste (MSW)? How have communities dealt with--and how should they deal with—the appropriate technology issue in choosing among resource recovery options?

The Appropriate Technology Issue

There are two generic approaches to resource recovery. The so-called low-technology or "recycling" approach involves household separation of recyclable materials. Decentralized and labor-intensive, it serves to somewhat reduce the volume of MSW requiring final disposal. High technology involves processing mixed MSW to recover energy and perhaps materials, usually at a centralized, capital-intensive plant. Energy recovery reduces the volume of incoming MSW greatly and represents an alternative to traditional disposal, although a backup landfill is still needed for residual material. The two approaches arose in response to different problems. Recycling approaches became popular following Earth Day 1970, during a time of growing concern for conserving natural resources and preventing waste. The development of energy recovery and centralized processing was spurred more by a gradual disappearance of cheap disposal methods, such as land-filling and incineration, and rising energy prices.

The question of which resource recovery technology is appropriate has been hotly debated, particularly in the mid-to late-1970s; it revolved as much around patterns of resource utilization and consumption as MSW disposal. At one extreme, advocates of the low technology approach decry what they perceive as an excessively high rate of resource consumption in the U.S.; they see source separation and recycling as a means to promote conservation and as a prelude to more effective waste reduction. They argue that high technology systems perpetuate and encourage high levels of waste generation.[1] These advocates also argue that large energy recovery plants erode local control, requiring communities to deliver contracted volumes of MSW and to make long-term commitments to a particular MSW disposal option.[2]

At the other extreme, proponents of high technology question the long-term effectiveness of any system that relies on volunteers (*i.e.*, residents to separate,

The two generic approaches to resource recovery are household separation of recyclable materials and the processing of mixed MSW to recover energy and materials.

This article is adapted from a thesis by Stephen A. Hill, written in 1980 as part of his work toward a Master of City Planning degree at Massachusetts Institute of Technology.

workers at recycling centers, etc.) to succeed. Claiming that source separation does not significantly reduce the volume of daily discards requiring disposal, they reject the contention that source separation and recycling in any way influence consumption habits. Regardless of those habits, they explain, there will always be a mass of residuals that cities will have to manage and to which recovery facilities can best respond.

More and more, high- and low-technology approaches are becoming accepted as complementary rather than mutually exclusive.

As experience has been gained with various projects incorporating each of the approaches, the views on the appropriate technology question have substantially moderated. There have been successful projects with both source separation and centralized processing. More and more, the two are becoming accepted as complementary rather than mutually exclusive; each is being looked upon as solving different types of problems. As for the issue of scale and local control, experience with modular (controlled-air) combustion units for energy recovery indicates the viability of small-scale plants, even if the duration of local commitment is not greatly reduced.

The Marblehead Case

What relevance do these arguments have for local government? Let us examine the case of one northeastern Massachusetts town and its approach to resource recovery. Marblehead is an affluent suburban community in the Boston metropolitan area, with a 1979 population of 21,500. It generates 11,400 tons per year of MSW, or about 31 tons per day. Residential MSW collection is performed by the town's Health Department. Before the early 1960s, refuse was taken to the town landfill. At that time, due to limited landfill capacity, the town landfill. At that time, due to limited landfill capacity, the town built an incinerator on the site.

Municipal involvement with resource recovery began in 1972, when residents voted to have the town take over a privately-operated recycling center and initiate a separate collection program for recyclables. Residents were to separate glass, newspapers and cans from other wastes, but no funding was provided for the separate collection program. Nonetheless, utilizing the Health Department's existing collection equipment and widespread community support, the town recycled an impressive 14-to-18 percent (by weight) of its residential MSW.[3]

In 1974, the U.S. Environmental Protection Agency (EPA) found Marblehead's incinerator to be in violation of federal emission standards, and local officials were faced with the choice of either closing it or making costly modifications. Lacking additional landfill sites in town, Marblehead considered a number of regional disposal options, including private landfills and three regional energy recovery projects in Massachusetts, all in the planning stages—RESCO in Saugus, Northeast Solid Waste Committee (NESWC) in Haverhill, and South Essex Solid Waste Council (SESWC) in Peabody. Town officials concluded that none of the energy recovery proposals would be operational in time, and were apprehensive about developing a modular incinerator system for the town itself. After further EPA pressure to act, Marblehead decided, in 1975, to develop a transfer station and pay $19 per ton to have its MSW hauled to a private landfill in Amesbury by Service Corporation of America (SCA), a private firm.

The new disposal fee represented nearly a doubling of the town's per-ton disposal cost, and town officials were eager to reduce costs. With a new incentive to reduce MSW tonnage, Marblehead applied to EPA for support in upgrading its separate collection program. Later in 1975, EPA awarded $80,000 to the town as part of a separate collection demonstration project. With this grant, the Health Department bought special collection vehicles, simplified the separate collection schedule, and publicized the program more widely. Marblehead signed a contract with a materials buyer for newsprint and mixed glass and cans, and participation in the recycling program improved dramatically. In its first 2½ years, the program consistently recycled more than 150 tons per month, diverted an average of 25 percent of residential MSW from the transfer station and saved the town about $2 per ton (net overall costs).[4]

In examining Marblehead's involvement with resource recovery activities, it becomes apparent that the town made three distinct choices: (1) a 1972 decision to expand an existing recycling program; (2) an early 1975 decision to pay for private hauling and landfilling; and (3) a decision later in 1975 to upgrade its materials recovery program. Each responded to a different situation and employed different choice criteria. The 1972 choice was elective; Marblehead's incinerator had not yet been cited for emissions violations and its citizens were mainly concerned with doing their share to conserve resources. No one expected recycling to reduce MSW disposal costs to the town. Incinerator costs were, in fact, fairly insensitive to minor changes in tonnage.

Similarly, Marblehead's third choice, the 1975 decision to upgrade its materials recovery program, was not made under pressure. Citizen support for recycling remained strong; the private hauling arrangement had been made, and its cost provided an incentive to reduce MSW tonnage: the town saved $19 in disposal costs for every ton of MSW not landfilled.

Earlier in 1975, however, Marblehead faced a much different situation in making the second decision. Under pressure from EPA to close its incinerator, the town had to select a MSW disposal option that would meet short-term disposal needs. Any one of the three regional energy recovery projects being planned could have met this need, but Marblehead could not wait. Two of the projects, NESWC and SESWC, were not close to construction; and RESCO, then under construction, was expected to be too expensive, considering its distance from Marblehead and anticipated tipping fees. Overall, town officials

found the private hauling/landfilling option preferable on several grounds: (1) it provided an immediate solution to their acute disposal problem; (2) it had no startup costs since SCA agreed to finance and build the transfer station; and (3) it retained a good deal of local flexibility. Flexibility—or low opportunity cost—was a particularly important criterion. As local disposal was considered infeasible, a transfer station was needed for any regional disposal option, and the town wanted to be able to join a regional energy recovery program if one should prove successful in the future.

Marblehead reaffirmed this decision in 1980 when its contract with SCA came up for renewal. By this time, the RESCO plant in Saugus was operating successfully and charging contracting communities a tipping fee competitive with many landfills. At least four other energy recovery proposals were being planned in northeastern Massachusetts as well. Marblehead, nonetheless, renewed its five-year contract with SCA, concluding that RESCO was not sufficiently cost competitive to justify a long-term contract. The town apparently is willing to pay a relatively high MSW disposal cost in the short term in order to keep its options open over the long term. Given the number of energy recovery plants proposed in the region and the expectation that plant reliability and economics will improve over time, this may be a good strategy.

The Community Choice

Three other examples—Ames, Iowa; North Little Rock, Ark.; and El Cerrito, Calif.—reinforce the Marblehead findings and offer other insights on how communities choose among resource recovery options and how they view the appropriate technology issue.[4]

Ames developed one of the first refuse-derived fuel (RDF) plants in the country—a plant which meets 10 percent of the fuel-energy needs of the city's coal-fired utility. El Cerrito, located in the San Francisco Bay Area, established an intensive recycling program in 1977, including curbside collection of recyclables and a materials buy-back program. North Little Rock contracted, in 1976, with a Consumat franchiser to develop a 100 tpd modular incinerator system, selling steam to a nearby creosoting plant.

Two important results emerge from an analysis of the resource recovery choice in each example. First, the communities tended not to worry about appropriate technology at all. The author found no cases of a municipality directly compairing low- and high-technology systems.[5] Instead, each tended to evaluate high- or low-technology options in relation to current disposal methods. Both Ames and North Little Rock compared energy recovery to their current landfilling arrangements in order to select a preferred MSW disposal strategy; El Cerrito considered only source separation alternatives prior to establishing an integrated materials recovery program. In no case was appropriate technology a factor in the town's choice.

Second, communities considering resource recovery tended to be predisposed toward either high- or low-technology alternatives, based on their particular objectives and waste disposal problems (see **Figure 1**). For example, with its incinerator about to be closed down and with little remaining capacity at its landfill, Marblehead in 1974-75 considered a variety of regional disposal options, including energy recovery. El Cerrito faced no such problem with landfill capacity, and public support prompted the city to develop an intensive recycling program. North Little Rock, too, had no immediate problem with landfill availability, but in order to promote economic development agreed to a small-scale energy recovery plant, which generated industrial steam at a time when natural gas supplies for industry seemed unreliable. Ames, expecting significant opposition to its efforts to site a new landfill and wishing to conserve resources, developed a refuse-to-energy plant instead. In each case, the alternative to the chosen resource recovery option was some variation of the status quo.

Why is this the case? The apparent lack of interest among local governments in engaging the appropriate technology issue can be explained largely by their different perspectives on the solid waste problem. As noted earlier, the appropriate technology debate has focused mostly on national issues of resource policy. Most local governments are not directly concerned with such matters as consumption patterns or rates of resource exploitation. Rather, they are more interested in net disposal costs, systems reliability, opportunity costs, compliance with environmental regulations and other performance variables.[6] While the national debate focuses on two generic approaches to resource recovery, communities must consider specific options at specific sites, each with associated costs, risks and benefits. The municipality's time frame is usually shorter, with priority on meeting short-term disposal needs. Finally, local governments do not always have to confront the full range of impacts of MSW disposal. For example, a local decision to haul MSW to a regional landfill (as Marblehead chose to do) would probably not be considered a valid long-term disposal solution from a regional or national perspective.

A city with little remaining capacity at its present landfill will be forced to make a choice between energy recovery and traditional disposal methods.

Suggestions for Communities

What can local governments learn from past resource recovery choices by other municipalities? On the basis of the four examples cited, two principal suggestions are offered.

First, a community should attempt to match its resource recovery choice to its MSW management problems and objectives. These circumstances and objectives should serve as a guide in defining and selecting resource recovery options. Remaining disposal capacity is an example of the circumstances affecting a community's choice. A city with little remaining capacity at its present landfill will be forced to make a choice between energy recovery and traditional disposal

Mixing low- and high-technology approaches provides a richer set of options for communities considering resource recovery.

methods. A low-technology approach alone will not work. It may be desirable to select an interim solution to provide adequate time to examine resource recovery options more fully, as Marblehead did in its 1975 contract with SCA. Conversely, a community with considerable disposal capacity can utilize low-technology strategies to extend the life of its landfill and reduce annual disposal costs.

A community will have many objectives against which to evaluate resource recovery options; system reliability is probably one of these. Reliability refers to the dependability of a resource recovery and disposal system—its flexibility, built-in redundancy and backup provisions. In general, the low-technology approach coupled with landfilling is more reliable due to its relative simplicity and fewer interdependent or sequential elements. For example, a paper baler breakdown at El Cerrito's recycling center would cause only a slight decline in system revenues as unbaled paper would either bring a lower per-ton price or be routed to the landfill. Energy recovery systems are, of necessity, complex and interactive. At the Ames plant, for example, clogged pneumatic tubes transporting the RDF product can cause the entire plant to shut down until the tubes are cleared.* Careful design can assure that a resource recovery plant is reasonably reliable, but this may mean a higher cost. In practice, siting a new landfill is often politically difficult and poses a different sort of "reliability" problem. The problem of acquiring new landfill capacity will recur more frequently using only a low-technology approach to resource recovery.

A second principal suggestion concerns the scope of a community's resource recovery analysis. Local governments should define resource recovery options broadly and realistically. There is a tendency in defining and evaluating options for a community to seize the first project that comes along. In North Little Rock, for example, the city considered only one alternative to the landfilling status quo.* This is only natural, in that project implementation takes so long and requires that options be foreclosed. Nonetheless, communities should define their options broadly and not rule out major alternatives too soon.

A point often overlooked in evaluating alternatives to the MSW disposal status quo is that present conditions tend to change—the "status quo" is not static. Landfill costs have risen sharply in most areas, and will continue to rise as land near urban areas becomes more scarce and as landfilling standards improve. In comparing resource recovery options with each other and with present disposal practices, a community should anticipate future trends in landfilling costs, state and federal regulations, energy prices, etc. Future trends are most relevant when long-term commitments are required, typically for large, capital-intensive recovery plants.

The appropriate technology debates obscure the possibility that high- and low-technology approaches to resource recovery are compatible; in theory, at least, this is the case. A combination of the two approaches may actually be desirable. Although there are no working examples of hybrid resource recovery systems, at least two local governments—Berkeley, Calif., and Atlantic County, N.J.—are planning such systems.* Both involve source separation of recyclable materials and modular incineration of the remaining MSW. In determining the compatibility of high- and low-technology approaches, both planning and sequencing are important. A successful combination is more likely if the high-technology system is developed after or at the same time as a low-technology source separation program. Berkeley's proposed system, for example, builds upon an existing curbside

Figure 1

Motivation for Considering Resource Recovery

	Low Technology				High Technology	
	Marblehead*				North Little	
Reason	(1)	(2)	(3)	El Cerrito	Rock	Ames
Need new disposal capacity		•				•
Face high or increasing disposal costs			•		•	•
Stringent state (or other) regulations		•				•
Local support for resource recovery	•		•	•		•
Demand for alternative energy					•	

*Choices:
(1) a voluntary decision in 1972 to start separate collection;
(2) consideration of energy recovery just prior to having its incinerator closed in 1975; and
(3) a late 1975 decision to upgrade its separate collection program after arranging for regional landfilling.

collection program for recyclables, adding a transfer station which incorporates front-end trommeling (to recovery additional glass and metals) and modular incineration.

Effective source separation enables a community to plan for a smaller energy recovery plant without jeopardizing its feasibility, potentially reducing the capital cost of the plant. EPA has estimated that, starting with an MSW composition similar to the national average, a source separation program that removes 60 percent of all paper from the waste stream would reduce the energy value of incoming MSW by less than nine percent.

A hybrid approach to resource recovery does not really resolve the appropriate technology question, since it leaves the issues of resource consumption and waste generation largely unaffected. Energy recovery, with or without recycling, still requires a steady flow of MSW, reinforcing present consumption and waste generation habits. Mixing low- and high-technology approaches does, however, provide a richer set of options for communities considering resource recovery.

Still another way to broaden the range of resource recovery options available to local government is to consider phased development. Typically, communities or regions plan resource recovery facilities that will, in one step, radically alter local solid waste management practices. In the past, this was often due to economy-of-scale constraints: a large facility was needed to achieve lower per-ton operating costs and competitive net costs. In northeastern Massachusetts, for example, each of several proposed energy recovery plants has been sized to utilize all the MSW produced in the entire region. The modular incinerator technology has probably altered the economies of scale argument, but most current proposals are still sized to serve an entire community or region. Phased development—for either low- or high-technology systems—can simplify the decision process, since less is at stake, and may improve the prospects for implementation and project success.

Conclusion

Local governments have taken—and will probably continue to take—primary responsibility for solid waste management, and will thus play a crucial role in implementing resource recovery projects, providing project sites or financing, contributing waste material, and controlling collection practices. An examination of how communities make resource recovery choices is thus of interest to both municipalities and state and federal policymakers.

Several implications for state and federal resource policies exist. General resource consumption issues aside, a policy which promotes high- or low-technology resource recovery to the exclusion of the other approach will be less successful than a mixed strategy, which acknowledges the range of municipal waste management needs and objectives. Nonetheless, state and federal governments are in a position to create incentives for municipalities and corporations that will affect the predominance of one or both resource recovery approaches. Such incentives can take the form of planning or demonstration grants, as was the case in Marblehead and El Cerrito. They include special financing provisions, such as industrial development finance bonds, and the streamlining of permit procedures, as was done by the Arkansas Department of Pollution Control and Ecology for the North Little Rock plant.

From the community perspective, as we have seen, high- and low-technology resource recovery are totally different options. The market, or state and federal policy, may favor one approach over the other; this will presumably be reflected in a community's analysis of and selection from among various resource recovery options. Fundamentally, though, a community's choice will rest more on local circumstances and objectives than the more general merits of low- or high-technology approaches to resource recovery.

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3. Town of Marblehead, Health Department, *Recycling: Marblehead, Massachusetts*, undated brochure.
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5. The Ames, North Little Rock, and El Cerrito examples are discussed in detail in *The Community Choice Between Low and High Technology Approaches to Resource Recovery*, by Stephen A. Hill, M.I.T. Laboratory of Architecture and Planning, 1980.
6. In at least two metropolitan areas—Washington, D.C., and Portland, Ore.—high-technology proposals have been rejected in favor of further study of both low- and high-technology options (see Neil Seldman, *op. cit.*). In neither case, however, were the two approaches seen as comparable substitutes.
7. See for example: Harvard University, Department of City and Regional Planning, *An Evaluation of Solid Waste Disposal Options for Rockport, Massachusetts*, Planning Workshop 401, 1977; and U.S. Environmental Protection Agency, *Resource Recovery Project Implementation: Case Studies of Five Processes*, by Development Sciences, Inc. (Washington, D.C.: U.S. Government Printing Office, 1977).
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... in resource recovery

Old Newspapers: Target for Recycling

The use of old newspapers (ONP) in the manufacture of newsprint should increase this year, as new deinking plant capacities come on line. Being expanded are Garden State Paper Co. (GSP) plants in Garfield, N.J., and Pomona, Calif., a Publishers Paper Co. plant in Newberg, Ore., and a Southwest Forest Industries facility in Snowflake, Ariz. In addition, current expansion of an Ontario Paper Co. facility in Thorold, Ontario, will increase demand for ONP in the Great Lakes region.

The American Paper Institute estimates that more than 800,000 tons of ONP will be used in 1981 in the production of some 1.3 million tons of recycled newsprint. This represents nearly 25 percent of the furnish for all newsprint produced in the U.S. Some of the deinking plants use 100 percent old newspapers to manufacture the newsprint; these include the GSP facilities noted, plus a company affiliate in Alsip, Ill. The others noted, plus those in Dublin, Ga., and Oregon City, Ore., use anywhere from 20 percent to more than 80 percent of old newspapers.

Unlike most conventional paper mills which operate in rural, forested areas of the country, recycled newsprint mills are usually located in metropolitan areas, near the source of waste paper supplies. The basic source of supply is the household. Basil Snider, GSP president, said recently that "perhaps as much as 95 percent of our product comes from the home, and it is the resident that plays the essential role in electing to save the newspapers for recycling."

Snider went on to say that the success of newspaper recycling depends on millions of individuals who volunteer their time and effort to what is a labor-intensive collection system. "People participate for any number of reasons," he said. "Some save old news to earn funds to support local causes. Others are attracted to the fact that recycling waste paper extends an important resource, our forests. It is an ultimate form of resource recovery and conservation."

While the major means of getting ONP from the home to dealers and eventually to the recycling mills is the various community drives and campaigns for charitable purposes, there is a slow but growing adoption of municipal curbside collection programs. One of the oldest is in Madison, Wis. As reported in a recent publication of the Michigan Department of Natural Resources, "Madison city officials are convinced that residents are willing to separate and bundle newspapers from other wastes, and that newsprint can be collected efficiently and economically. Between 1971-79, the newspaper recycling program provided $35,000 to city coffers, saved over $181,000 in landfill fees and hauling costs, conserved almost 400,000 trees that would have become newsprint, and saved 117,125 cubic yards of landfill space."

Madison also has another successful resource recovery project (see *NCRR Bulletin*, December 1980); an energy-from-solid waste facility that also separates ferrous metals. The programs and experience of Madison are serving to answer a troublesome question sometimes raised about the impact of energy recovery on waste paper recycling. Madison is demonstrating that both programs can be compatible.

Recovery Capacity Approaches 48,000 TPD

A decade ago, the pioneer materials recovery plant in Franklin, Ohio, was preparing to begin operation, and a scant handful of municipal incinerators were using the heat from burning refuse to generate steam.

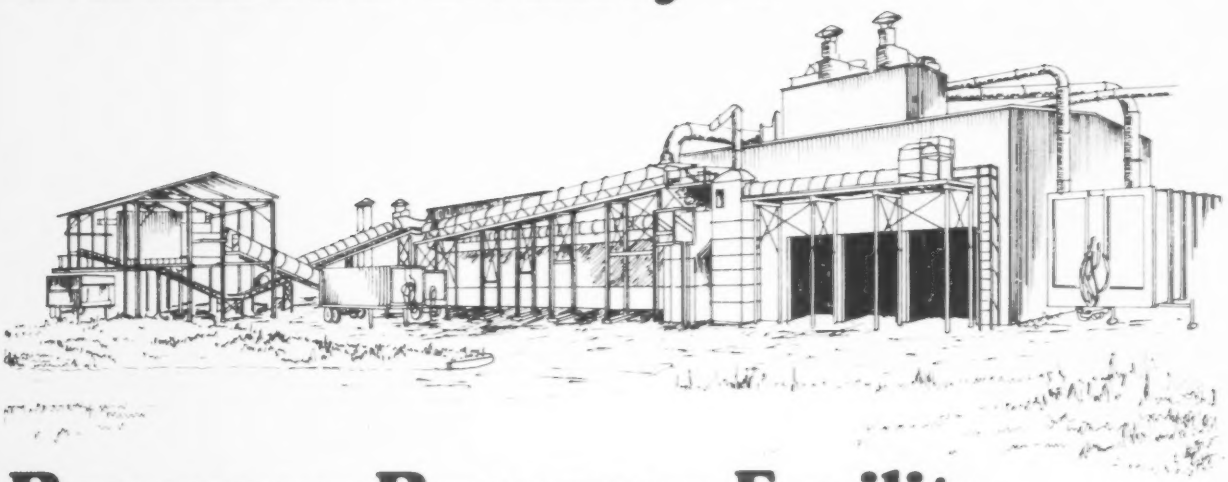
Today, according to figures compiled by the *NCRR Bulletin*, 63 materials and/or energy recovery facilities in the U.S. are operating, in shakedown, under construction or in advanced planning stages. The total processing capacity of these plants is about 48,000 tons per day (tpd) of municipal solid waste, and their capital costs total almost $1.9 billion.

The "Resource Recovery Activities" report elsewhere in this issue shows 41 facilities currently operating or in shakedown, with a total capacity of about 25,000 tpd. Capital costs for these plants are about $720 million. Of these 41 plants, eight are temporarily closed for modifications or other reasons. The 22 facilities being constructed or in advanced planning and contract-signing stages total more than 22,000 tpd in capacity and represent capital costs in excess of $1.15 billion. The figures also reflect the relatively recent application of small, controlled-air "modular" combustion units to energy recovery, particularly in smaller communities. "Activities" reports on 12 units operating or in shakedown and 7 under construction or planned, ranging in size from 7 to 240 tpd.

Though details of capacity and cost are not available for many of the 41 plants listed as being in earlier stages of planning, the addition of these facilities will probably double the total capacity and cost figures.

The recovery of methane gas from landfills also has increased dramatically in recent years. Nine methane-from-landfill projects are listed as operating, with seven more under construction or in advanced planning stages.

Baltimore County's



Resource Recovery Facility

Maryland Plant Plays Dual Role of MSW Processor and Researcher

In the early 1970s, Baltimore County, Md., eagerly sought an efficient way to dispose of its solid waste. The Maryland Environmental Service (MES), then a newly-formed state agency with solid waste responsibility, wanted to establish a research facility to investigate resource recovery. Cooperation between the two entities led both to their goals.

Through a joint effort of the county, MES and the private firm of Teledyne National, the county's refuse has been shredded and landfilled for the past five years, ferrous metals have been extracted and sold, refuse-derived fuel (RDF) has been produced whenever needed for test burning, and other resource recovery research projects have been conducted.

It All Started . . .

The Baltimore County landfill at Cockeysville—a suburb north of Baltimore—was rapidly reaching capacity a decade ago, and the county was forced to quickly find another place or another method for refuse disposal. Siting a new landfill was, as always, difficult; because of local resistance and other factors, it has taken the county an average of three-to-five years to procure a landfill in recent decades. A site was acquired in the less-densely-populated northern part of the county. The county decided to build a transfer station at the Cockeysville site and haul the refuse 18 miles to the new landfill.

A study was made for the county in 1972 by Green and Associates, Inc., to determine the best method for landfilling. The conclusion was that either baling or shredding at the transfer station would be preferred; the county decided on baling. Meanwhile, the county had to take immediate action. A composting operation, which lasted for about a year, saved the necessary amount of land at the Cockeysville landfill to site the present plant.

While the county was planning the balefill operation, the Maryland Environmental Service, which had just entered the solid waste field, proposed that MES fund one-half the plant if it could be used as a research facility for resource recovery processes. This would, of course, entail shredding rather than baling, since nothing could be recovered from baled refuse. This was no great obstacle, since shredding had been the county's second choice.

In December 1973, the county and MES signed a contract to build the plant and share construction costs equally; in October 1975, an amendment added a transfer station to the project.

Teledyne National was selected to build and operate the facility. Teledyne, recalled Charles E. Farley, chief of Baltimore County's Bureau of Sanitation, emphasized materials handling experience rather than "black boxes." Teledyne proposed using equipment proven in other processes, which could be modified to process refuse. (While that concept is not popular today, recall that few companies had actual experience with building and operating resource recovery systems in 1974.) The broad-based Teledyne group of companies also had considerable engineering and research capabilities and experience to call upon.

The facility began shredding municipal solid waste (MSW) for transfer to landfill and recovering ferrous metals in January 1976. According to Farley, it has operated continuously since then, except for a few days following a major explosion in a shredder in January 1977. The transfer station in the southwest part of the county opened in June 1978.

The Baltimore County Resource Recovery Facility processes about 70 percent of the county's residential solid

"Burning RDF to produce energy is not as mysterious as some people have made it appear."

Baltimore County

waste. All incoming waste is residential, except for limited amounts of commercial waste collected from a few small businesses along with residential refuse. Collections are made by 52 small contractors, on a per-ton/mile base contract with the county. Most of the waste is brought directly to the processing plant; but about 200-250 tons per day are taken to the transfer station, about 25 miles away, and brought to Cockeysville by transfer trailers. The remaining commercial and residential waste is received at another landfill in the northwestern sector of the county.

Flow Description

The Baltimore County plant is today only partially operational; the glass recovery system is being tested and may be modified, and the aluminum recovery system is not being operated at all. It is not anticipated, however, that the general flow will change substantially.

Incoming collection trucks, which are weighed before entering the tipping area, dump either directly into one of two push-pits or into a storage pit, from which the MSW is moved into the push-pits via overhead crane. (Pits are used because there is not enough room on the site for a facility with a tipping floor.) It is moved by hydraulic ram and blade from the two push-pits onto the shredder infeed conveyors. Hydraulic grapples allow the shredder operators to remove unwanted objects from the lines before they reach the shredders. The two primary shredders are Tracor Marksman horizontal hammermills, driven by 1000-hp motors and rated at 55 tons per hour (tph) each.

Ferrous metals have been recovered since the plant began operating in 1976.

The shredders are equipped with a Fenwall explosion suppression system, as well as blow-out panels and heavy "blast mats." The 1977 explosion has been the only one of major significance. It is thought to have been caused by discarded explosives. The plant was restored to partial operation, using one shredder, three days after the explosion; full operation was resumed in two months.

Fact Summary
Baltimore County Resource Recovery Facility

Opening:	January 1976
Principals:	**Baltimore County and Maryland Environmental Service** – owner **Teledyne National** – designer and operator
Volume:	Design: 1600 tpd Actual: 1200 tpd Current throughput: 850 tpd
Technology:	Shredding, magnetic separation, air classification, rotary and other screening, secondary shredding, pelletizing for RDF densification, crushing and screening for glass recovery (eddy current separation for aluminum recovery not in use)
Products:	Refuse-derived fuel (fluff or densified), ferrous metals, glass
Costs & Revenues:	$10 million for facility and transfer station, shared equally by Baltimore County and Maryland Environmental Service Operating costs: approximately $20/ton including resource recovery facility, transfer station and transportation (about $5.2 million total operating costs expected in FY 1981); operating costs of recovery facility alone approximately $12.50/ton Revenues from sale of products: d-RDF – $27/ton; ferrous metals – $33/ton (about $500,000 in revenues expected in FY 1981)

After being shredded to a nominal four-inch particle size, the refuse is conveyed to the magnetic separation area, where magnetic metals are removed by Dings three-stage, overhead, belt magnets—one on each line. About 3½ percent by weight of incoming waste is recovered as ferrous product; the recovery rate is in excess of 95 percent. There is no additional cleanup of the ferrous product, and it is clean enough to meet the requirements of the user, Bethlehem Steel Corp. Kenneth Cramer, Teledyne's plant manager, said that the ferrous product has been tested by both Teledyne and Bethlehem Steel and found to contain five percent or less of contaminants.

After magnetic separation, the remaining material from both lines is combined on one belt conveyor and taken to the RDF processing area.

The system for processing RDF does not, at this time, have the capacity to accommodate the plant's entire throughput; additional capacity may be added as RDF customers are located. The desired amount of refuse is routed into the air classifier; the remainder is diverted into a compactor, from which it is transported to landfill.

The air classifier, a vertical shaft unit built by Montgomery Industries and redesigned by Teledyne, is usually adjusted for a 60/40 split (lights/heavies).

The light fraction from the air classifier is screened through a one-stage Triple/S Dynamics trommel, which is 12 feet in diameter and 28 feet long with 1¼ inch screen. The undersize material is delivered to landfill as rejects.

If the fuel customer prefers a large particle size, the trommel oversize material may be shipped as four-inch fluff without undergoing secondary shredding. If a finer fluff or densified RDF (d-RDF) is desired, secondary shredding produces a one-inch fuel product. Heat content of the RDF fluctuates with the season, rainfall, etc., but has averaged about 6500 Btu per pound according to plant manager Cramer.

A cloud of steam rises from newly-made d-RDF pellets as they hit the winter air. Examining the pellets are, from left: John Peacock, Maryland Environmental Service; Kenneth Myers, Teledyne National; and Charles Farley, Baltimore County.

There are two secondary shredders, both horizontal mills. At present a six-tph Gruendler is being used, since the amount of throughput is low. When more throughput is required, a 25-tph Williams 800-hp mill will be used.

When producing fluff RDF, the product is conveyed from the secondary shredder to a compactor and transfer trailer for transport. When d-RDF is being produced—as it is now—the fluff is conveyed to pellet mills for densification.

Three pellet mills are used: one California Pellet Mill and two Sprout-Waldron machines. While one of the Sprout-Waldron units has just been installed, the other two mills have been used for more than a year to produce one-half-inch diameter pellets at a rate of about two tons per hour each on a long-term basis. Fuel pellets are loaded onto transfer trailers for transport to the fuel user.

The heavy fraction from the air classifier goes through a two-stage sizing trommel, about 10 feet in diameter and 16 feet long. The first stage is a one-inch screen; the unders from this stage form the glass-rich fraction. This fraction is cleaned up by a shaker table with ¾ inch screen and a Triple/S air table; a Williams horizontal hammermill then crushes it to minus 20 mesh. This mill is rated at 10 tph for glass pulverization.

The trommel's second stage is a four-inch screen; the fraction extracted here is the aluminum-rich portion of the waste stream. This fraction is routed through a Carpco eddy current separator to remove the aluminum. Rejects from the glass and aluminum systems, as well as the trommel overs, go to landfill.

The $10 million cost of the facility was divided equally between Baltimore County and the Maryland Environmental Service.

RDF Tests

Though the plant does not have a steady market for large amounts of RDF, several test burns have been conducted using fuel from Baltimore County. One of these was a 30-day test burn in December 1979 at the Lehigh Portland Cement Co. in Union Bridge, Md. A total of 1400 tons of fluff RDF was burned in a rotary kiln, contributing about 30 percent of kiln heat. Tests included air emissions, cement quality and chemistry, RDF characteristics and checks on kiln operation. The tests

showed that RDF could be successfully fired with coal at rates of at least up to 30 percent of the heat value with no detrimental effect on the cement quality. (For further information on this application, see "Processed Refuse as a Cement Kiln Fuel," *NCRR Bulletin*, June 1980, pp. 43-47.)

Other tests with fluff RDF included one last year when 2200 tons of RDF were burned by Baltimore Gas and Electric Co. in a utility boiler, and an earlier test in which fluff RDF was co-fired with wood bark in a bark-burning boiler at a Pennsylvania paper mill.

Cramer explained that the burn tests have been useful both for the plant and the RDF users. "They have learned a lot about burning RDF. It's not a big mystery—you have to have the right equipment to handle RDF, but you can recover heat from it, and it's not as mysterious as some people have made it appear."

The current market for RDF from the plant is the U.S. Air Force at Wright-Patterson Air Force Base near Dayton, Ohio. Under a three-year contract beginning in the fall of 1978, the plant provides up to 8000 tons per year of densified RDF for test-burning at Wright-Patterson. The half-inch diameter pellets are shipped to Wright-Patterson via truck and rail. The facility is paid $27/ton f.o.b. Cockeysville.

There have been a number of changes and modifications in RDF production at the plant since it began operating in 1976—primarily to decrease the ash content and make the fuel cleaner and easier to burn. A full commitment was not made for the "back end" of the plant; the present RDF processing system will handle only about 40 percent of the incoming waste. If sufficient markets materialize, the RDF processing system may be expanded. Recent fossil fuel price increases, said Cramer, have prompted renewed interest in refuse fuel by several fuel users, and several businesses have called to inquire about the plant's capabilities and the status of experimentation with RDF.

The general feeling among those concerned with the plant is that it is ready to produce a good, usable fuel, but that industry is not ready to use that fuel.

Marketing Materials

Ferrous metals have been recovered since the plant began operating. Originally the ferrous was sold to a detinner in Delaware, which has since gone out of business. For the past three years or more, the ferrous metals—about 25-to-30 tons per day—have been sold to Bethlehem Steel, which uses it as feedstock in the Sparrows Point steel mill in southeastern Baltimore County.

Glass recovery and clean-up procedures are being tested and refined, and the glass system does not operate full-time yet. When it is operating satisfactorily, Owens-Corning Fiberglas Corp. will buy the glass product to use in making fiberglass, probably at the company's Barrington, N.J., plant. Teledyne has been working with Owens-

Burning d-RDF at Wright-Patterson

Wright-Patterson Air Force Base, near Dayton, Ohio, has test-burned densified refuse-derived fuel from the Baltimore County resource recovery facility for more than two years. Of the 2300 tons burned thus far, about 500 tons were burned during February and the first half of March 1981—*including a week of firing 100 percent d-RDF.*

Most burning has been a mixture of d-RDF pellets and coal, about 1:1 volumetrically, according to Tom Shoup, chief of Environmental Planning at Wright-Patterson. At this ratio, d-RDF supplies about 25 percent of the heating value for the boilers.

"RDF has, by and large, been an excellent fuel substitute for us," said Shoup. He said there have been no problems in burning the pellets—even with the 100 percent RDF test burn—despite the fact that the pellets had been stored outside, uncovered, for about two months. Emissions, controlled by electrostatic precipitators, have been acceptable.

Three spreader stoker, chain grate boilers in two different power plants have been used for the tests. The boilers supply steam and high-temperature hot water for the base; about 90 percent is for space heating, and 10 percent for process use.

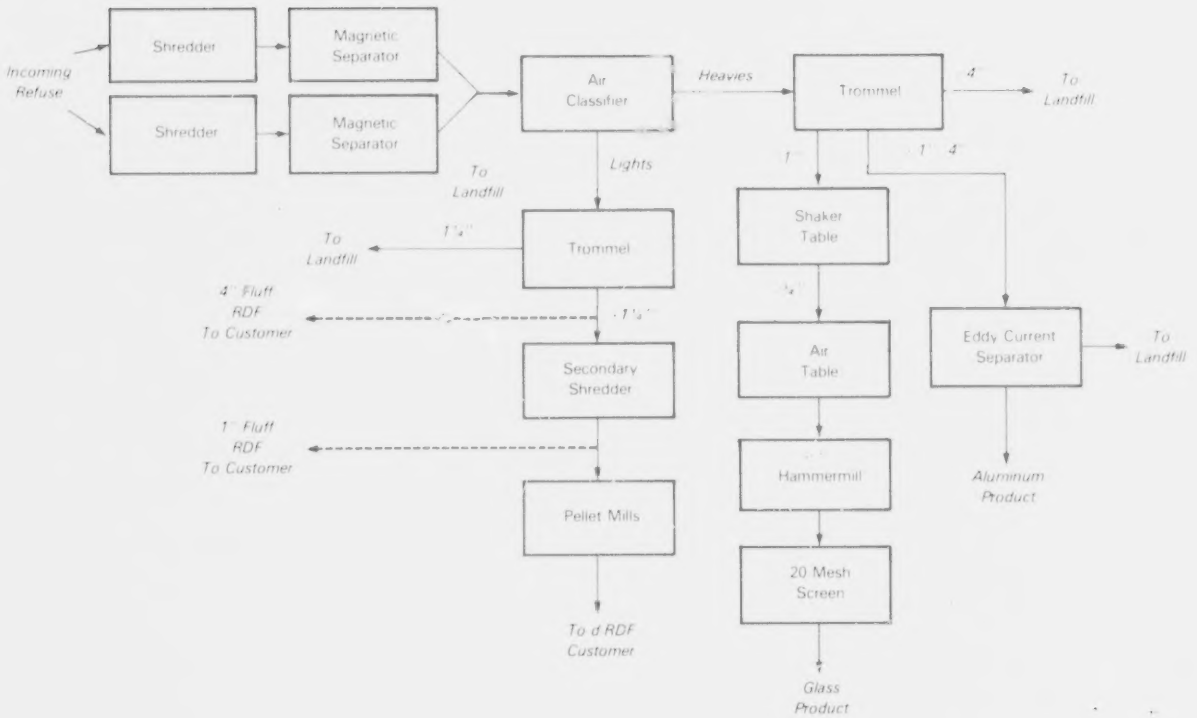
There have, however, been some difficulties in handling pellets with high moisture content during the summer. The moisture causes low pellet density, contributing to increased breakage and other handling and storage problems; it also exacerbates an odor problem.

Another problem has been the fine, fibrous dust from the air classification system that is contained in the pellets and freed during handling. The RDF dust is filtered from the air by the same masks the power plant workers wear to avoid breathing coal dust.

The three-year contract with Baltimore County expires next fall, and the fate of the burning program is uncertain. Though continuation of the contract has not been ruled out, long-distance shipping is expensive; in addition to the $27/ton cost of the pellets, shipping costs are about $23/ton by rail or $56/ton by truck. On a comparative Btu basis, the d-RDF costs about twice as much as coal. The taxpayers' money is being spent wisely, said Shoup; the program is yielding a great deal of information. But when the research is finished, it would not make good economic sense to continue burning such expensive fuel.

Wright-Patterson is, however, pleased with the d-RDF and would like to continue using it, perhaps from a local supplier. Ideally, Shoup said, he would like to burn 100 percent RDF in the summer when the boilers' load is low, and burn both RDF and coal in the winter.

Process Flow
Baltimore County Resource Recovery Facility



Corning for about two years, sending samples to Owens-Corning laboratories in Columbus, Ohio, for testing. For fiberglass manufacture, color-sorting is not required, and the process does not require that the feedstock be free of ceramics and stone, as would be the case in container manufacturing.

Teledyne is trying to use the pilot-scale equipment installed in the facility for research and demonstration purposes and change it into production equipment for the least cost, Cramer said. Owens-Corning requires a steady operation, so they may expect a constant flow of material—the same amount each week—and set their process equipment to accept that amount of used glass without significant variations.

Researchers from Teledyne have also developed products which may be manufactured from the used glass, including a foamed-glass product for insulating and building materials. This product has been patented and the patent assigned to MES. The original concept of the plant included a production facility to manufacture such products; however, studies showed that the break-even point for such a facility is about 100 tons of recovered glass a day. With a design capacity of 1200 tpd, the Baltimore County facility would have only 80-85 tpd of glass if all of it could be recovered.

Revenues from the sale of RDF and ferrous metals for fiscal year 1981 are expected to be about $500,000.

Aluminum recovery equipment, which was installed in the plant for R&D purposes, has only been operated experimentally for a short period. Only about one-fourth of one percent of the waste stream is aluminum—not enough to make recovery economically feasible.

Costs and Revenues

Total capital costs for the plant and the associated transfer station were $10 million—$8.4 million for the resource recovery facility and $1.6 million for the transfer station. This figure also covered some of the research and development that was conducted at the plant. As noted, this $10 million was divided equally between the county and the Maryland Environmental Service. The county's portion of the cost was financed through a capital improvement program.

The contract with Teledyne National is on a budgeted cost-plus-fee basis: MES pays Teledyne and then bills the county for the operating costs. In the fiscal year ending June 30, 1980, the plant processed 242,000 tons of waste at a total operating cost of about $20 per ton—including costs of the facility, the transfer station and associated transportation. Transportation costs are

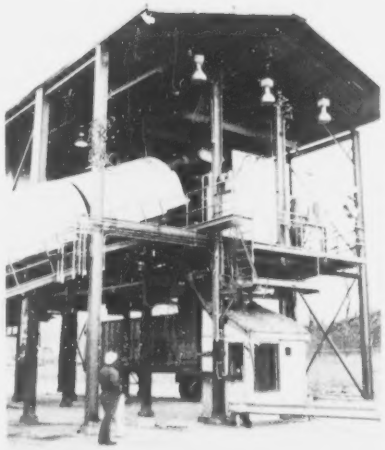
Baltimore County

quite significant, with distances of 25 miles to the transfer station and 18 miles to the landfill. Of that $20 per ton, operating costs at the Cockeysville facility were about $12.50 per ton.

Revenues from the sale of recovered materials and RDF go into the county's general fund at present, though eventually some will go to the state. Under the contractual agreement, when revenues exceed operating costs for the recovery portion of the plant, a certain percentage of the revenues will go to the state to repay the reimbursible grant that financed the state's share of the facility costs. Revenues have been very low so far, and the recovery portion of the plant is still operating "in the red," but Cramer said he expects to cross over into the black in the near future. Revenues from the sale of RDF and ferrous metals for fiscal year 1981 are expected to be about $500,000.

Representatives of Baltimore County, MES and Teledyne National work very closely with each other on both the day-to-day operation of the plant and the practical application of what is being learned for the future of Baltimore County and other such projects.

The goals of the facility from the county's point of view were voiced by Chief of Sanitation Charles Farley: "a reduction in the cost of disposal, and the savings that are inherent with it—such as land savings." The key to the realization of these goals, and the overall success of the project, will be the procurement of long-term markets for the RDF. Further success will come with steady production of recovered glass. In the meantime, the principals of this unique partnership are providing an essential service in furthering the development and application of resource recovery.



A three-stage, overhead belt magnet (at top of inclined covered conveyor) removes ferrous metals from the shredded refuse. The metals are dropped into the trailer in background.

This article was prepared by Ronald W. Musselwhite, NCRR Bulletin managing editor.

Resource Recovery Activities

This listing of resource recovery facilities in the United States, prepared and distributed by the National Center for Resource Recovery, Inc., since 1974, is broken down into three segments: (1) recovery of materials and energy from processed municipal solid waste (MSW) or burning of unprocessed MSW; (2) recovery of methane gas from MSW landfills; and (3) jurisdictions which report being committed to undertake one or more forms of resource recovery. Not included is the growing number of communities which are conducting source separation programs and/or magnetically separating ferrous metals from mixed refuse.

Although every effort has been made to make this report as complete and current as possible, the dynamics of resource recovery are such that project status can change at any time. For clarification or additional information on a specific facility, we suggest that you write directly to the source given for that listing.

The National Center is grateful for the contributions and cooperation of each project representative, as well as that of the U.S. Department of Energy, U.S. Environmental Protection Agency, and local and state governments.

Materials and Energy Recovery Facilities

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
ARKANSAS						
Batesville City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	50	1.07	Startup expected in April 1981	Peyton Golden, Mayor Municipal Bldg. 170 S. Forth St. Batesville, Ark. 75201
Blytheville City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	70 (to be processed)	N/A	Temporarily closed; awaiting delivery of new incinerators	Tom Little, Mayor City Hall Blytheville, Ark. 72315
North Little Rock City; U.S. Recycle Corp. (Mfr: Consumat)	Mass burning in modular incinerator	Steam	100	1.45	Operational	Mike Butner, Pres. U.S. Recycle Corp. P.O. Box 7561 Little Rock, Ark. 72217
Osceola City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	50	1.1	Operational	R.E. Prewitt, Mayor City Hall Osceola, Ark. 72370
CONNECTICUT						
Bridgeport Conn. Resources Recovery Auth.; Occidental Petroleum Corp. and Combustion Equipment Assoc. (designer/operator)	Shredding, air classification, magnetic separation, Eco-Fuel* II production process (aluminum and glass recovery equipment not in use)	Eco-Fuel* II (powdered fuel) for use in utility boiler, ferrous metals	1800	53	Temporarily closed due to CEA's financial difficulties; Occidental has taken over facility and met with CRRA and municipalities on re-opening; decision on plant's future expected about May 30	Wanda A. Rickerby Public Affairs Coordinator Conn. Resources Recovery Authority 179 Allyn St. Hartford, Conn. 06103

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
CONNECTICUT (cont'd)						
Windham Town of Windham (Mfr: Consumat)	Mass burning in modular incinerator	Steam	108	3.7	Under construction, start-up expected in Summer 1981	Ken Williams First Selectman Town of Windham Town Office 979 Main St Willimantic, Conn. 06226
DELAWARE						
Wilmington Delaware Solid Waste Authority; EPA; Raytheon Service Co. (designer)	Shredding, air classification, magnetic separation, froth flotation, other mechanical separation; aerobic digestion	Ferrous and nonferrous metals, glass, RDF, humus	1000 tpd municipal solid waste co-processed with 350 tpd of 20% solids digested sewage sludge	71.3	Under construction, start-up expected in late 1982	Pasquale S. Canzano Chief Engineer Delaware Solid Waste Authority P.O. Box 981 Dover, Del. 19901
FLORIDA						
Dade County (Dade County Solid Waste Resource Recovery Plant) County; Parsons & Whittemore, Inc. (designer/operator)	Hydrasposal™ (wet pulping), magnetic and other mechanical separation	Steam for utility to produce electricity, aluminum, ferrous metals	3000	165	Construction almost complete, startup depends upon resolution of contract dispute between P&W and County	Dennis Carter Asst. County Manager Room 911 Dade County Courthouse 73 W. Flagler St. Miami, Fla. 33130
Dade County (Agripost Composting Plant) County; Agripost, Inc. (owner/operator/designer)	Composting	Soil conditioner	400	8.5	Contract signed; facility under design (pilot plant)	(Same as previous listing)
Lakeland City (operator and joint owner with Orlando Utility Commission); C.T. Main, Inc. (power plant designer); Horner & Shifrin, Inc. (waste processing plant designer)	Shredding, magnetic separation, burning RDF with coal	Steam to produce electricity for use by City of Lakeland and Orlando Utility Commission, ferrous metals	300	5 (for waste processing plant)	Under construction, start-up expected in mid-1981	Claude Hiers Supt. of Industrial Engin & Business Affairs Box 368 Lakeland, Fla. 33802
Orange County (Walt Disney World) U.S. Dept. of Energy, Idaho Operations Office; Reedy Creek Utilities Co.	Slagging pyrolysis incineration (Andco-Torrax)	High temperature water for heating and cooling	100	15	Under construction, completion expected in March 1982 (demonstration plant)	Carl P. Gertz Project Manager U.S. Dept. of Energy 550 Second St. Idaho Falls, Idaho 83401
Pinellas County County; Florida Power Corp.; UOP, Inc.	Mass burning, mechanical separation of metals after burning	Electricity, ferrous and nonferrous metals	2000	160	Construction began Aug 1980, operational in 3 years	Don F. Acenbrack Director, Solid Waste Dept. of Public Works and Utilities Pinellas County 315 Court St. Clearwater, Fla. 33516
Pompano Beach Waste Management, Inc.; U.S. Dept. of Energy; Jacobs Engineering Co. (designer)	Shredding, air classification, magnetic and other mechanical separation, anaerobic digestion of air classified light fraction with sewage sludge	Methane gas, carbon dioxide	50-100	3.65	Operational (demonstration plant)	Ted Sjoberg Dir. of Engineering Waste Management, Inc. 900 Jorie Blvd. Oak Brook, Ill. 60521

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
HAWAII						
Honolulu City and County of Honolulu; Combustion Engineering, Inc. (designer); Amfac, Inc. (operator)	Shredding, magnetic separation, trommel and other screening, burning RDF with bagasse in spreader stoker boilers for cogeneration of steam and electricity	Ferrous metals, steam for sugar cane processor, electricity for utility	1800	90	Contracts being finalized; construction expected to begin in Summer 1981	Noel Hazzard Marketing Manager Resource Recovery Div. Combustion Engineering, Inc. 1000 Prospect Hill Road Windsor, Conn. 06095
IDAHO						
Burley Cassia County (Mfr. Consumat)	Mass burning in modular incinerator	Steam	50	1.5	Operation expected by end of 1981	Norman Dayley County Commissioner Cassia County Court House Burley, Idaho 83318
ILLINOIS						
Chicago (Northwest Incinerator) City; Metcalf & Eddy, Inc. (designer)	Mass burning in water-wall incinerators, ferrous recovery from ash (intermittent)	Steam for process use on-site and by Brach Candy Co., ferrous metals	1600	23	Operational	Emil Nigro Supervising Engineer Dept. of Streets & Sanitation Room 700, City Hall Chicago, Ill. 60602
Chicago (Southwest Supplementary Fuel Processing Facility) City; Ralph M. Parsons Co. and Consoer, Townsend & Assoc. (designer)	Shredding, air classification, magnetic separation	RDF for use by utility, ferrous metals	1000	19	Off-stream to review experience and evaluate future operations; decisions pending	(Same as previous listing)
IOWA						
Ames City; Gibbs, Hill, Durham & Richardson, Inc. (designer)	Baling waste paper, shredding, magnetic separation, air classification, screening, other mechanical separation	RDF for use by utility, baled paper, ferrous metals, aluminum, other nonferrous metals	200 (50 tph)	6.3	Operational	Arnold Chantland, Dir. Dept. of Public Works City Hall 5th and Kellog St. Ames, Iowa 50010
LOUISIANA						
New Orleans City; Waste Management, Inc. (owner/operator); National Center for Resource Recovery, Inc. (designer/implementer)	Shredding, air classification, magnetic and other mechanical separation	Ferrous metals, aluminum, glass	700	9.1	Shredding/landfilling and ferrous recovery operational; aluminum and glass recovery in shakedown	Clifford Scineaux, Dir. Dept. of Sanitation City Hall New Orleans, La. 70112
MAINE						
Auburn City (Mfr. Consumat)	Mass burning in modular incinerator	Steam	200	3.97	Startup expected in Spring 1981	Robert Belz Public Works Auburn City Hall 45 Spring St. Auburn, Maine 04210
MARYLAND						
Baltimore City; EPA	Shredding, pyrolysis in rotary kiln, steam production	Steam for use in heating/air conditioning steam loop by utility	600	30.1	Temporarily shut down for modifications	Ed May Baltimore City Pyrolysis Plant 1800 Annapolis Rd. Baltimore, Md. 21230

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
MARYLAND (cont'd)						
Baltimore County County; Maryland Environmental Service; Teledyne National (designer/operator)	Shredding, air classification, magnetic and other mechanical separation, pelletizing	RDF, ferrous metals, glass	1200	8.4	Operational; recovering ferrous metals and producing shredded and pelletized RDF; glass recovery system being developed and refined; aluminum recovery not in use	Kenneth Cramer Teledyne National Padonia Centre, Ste. 401 30 E. Padonia Rd. Timonium, Md. 21093
MASSACHUSETTS						
Braintree City (owner/operator); Camp, Dresser & McKee Inc. (designer)	Mass burning in waterwall furnace	Steam (half of steam produced used by Art & Leather Co.)	250	2.8	Operational	Edward Courchene, Supt Braintree Thermal Waste Reduction Center Ivory Street Braintree, Mass. 02184
East Bridgewater City of Brockton and nearby towns; Combustion Equipment Assoc.; East Bridgewater Assoc.	Shredding; air classification; magnetic separation; other mechanical separation and production of Eco-Fuel® II	Eco-Fuel® II for industrial boiler; ferrous metals	550 being processed	10-12	Plant has served as pilot operation for Eco-Fuel® II production and recently for Eco-Fuel briquet production; currently closed due to CEA's financial difficulties	Barbara A. Koeth Public Information Mgr Combustion Equipment Assoc. 555 Madison Ave New York, N.Y. 10022
Haverhill & Lawrence Refuse Fuels, Inc. (owner); Raytheon Service Co. (designer/operator); Cities of Haverhill & Lawrence	Shredding, magnetic separation, trommel screening at recovery facility in Haverhill; burning RDF for cogeneration of steam and electricity in Lawrence	Steam and electricity for industrial use; surplus electricity sold to utility	1200	78	Contracts being finalized; construction expected to begin in May 1981, with full operation in 3 years	James E. Ricci, Vice Pres. Refuse Fuels, Inc. P.O. Box 187 Bradford, Mass. 01830
Pittsfield City, Vicon Recovery Assoc.	Mass burning in modular incinerator	Steam	240	6.2	In shakedown; full operation expected in Spring 1981	Joseph J. Domas, Jr., Pres. Vicon Recovery Assoc. P.O. Box 100, Butler Center Butler, N.J. 07405
Saugus Thirteen communities including Saugus and part of northern Boston; RESCO (owner/operator)	Mass burning in waterwall furnaces; magnetic separation	Steam for electrical generation and industrial use; ferrous metals	1200	50	Operational	Joseph Ferrante Wheelabrator-Frye, Inc. Liberty Lane Hampton, N.H. 03842
MICHIGAN						
Detroit City; Combustion Engineering, Inc./Waste Resources Corp.	Shredding, air classification, magnetic separation, burning RDF in dedicated boilers	Steam for use in Detroit Edison's existing steam loop and electricity during off-peak periods; ferrous metals	3000	125	Negotiating with Combustion Engineering, Inc./Waste Resources Corp. prior to contract signing; preparing a revenue bond issue to finance the facility	Michael Brinker Dept. of Public Works City of Detroit City-County Bldg., Rm. 513 Detroit, Mich. 48226
Genesee Township Township (Mfr: Consumat)	Mass burning in modular incinerator	Steam	100	2	Operation interrupted due to lack of steam customers; negotiating with prospective customer	Hanumanthaiya Marur, P.E. Engineer 1202 S. Grand Traverse Flint, Mich. 48503
MINNESOTA						
Duluth Western Lake Superior Sanitary District (owner/operator); Consoer, Townsend & Assoc. (designer)	Shredding, magnetic separation, air classification, secondary shredding, fluidized bed incineration of RDF and sludge	RDF, ferrous metals, steam for heating and cooling of plant and to run process equipment	400 of MSW; 340 of 20% solids sewage sludge	19	In shakedown; full operation expected in late 1981	John Klaers Western Lake Superior Sanitary Dist. 27th Ave. West & The Waterfront Duluth, Minn. 55806

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
MISSOURI						
Ft. Leonard Wood U.S. Army (Mfr: Environmental Control Technology)	Mass burning in modular incinerator	Steam	75	3.3 (approx.)	Under construction; start-up expected in Jan. 1982	Robert Fuerst Facility Engineers Building 2200 Ft. Leonard Wood, Mo. 65473
NEW HAMPSHIRE						
Durham (Lamprey Regional Solid Waste Cooperative) Members of 12-town cooperative (Mfr: Consumat)	Mass burning in modular incinerator	Steam	108	3.3	Operational since Dec. 1980	Malcolm Chase, Chairman Lamprey Regional Solid Waste Cooperative 13-15 Newmarket Rd. Durham, N.H. 03824
Groveton City; Groveton Paper Mill, Inc. (Mfr: Environmental Control Products)	Mass burning in modular incinerator	Steam	24	N/A	Operational	Rick Coville Groveton Paper Mill, Inc. Groveton, N.H. 03582
NEW JERSEY						
Newark City; Combustion Equipment Assoc. and Occidental Petroleum Corp. (designer/operator)	Shredding, air classification, magnetic and other separation, production of Eco-Fuel® II	Eco-Fuel® II for use by utility; ferrous metals, aluminum	3000 (in 1000 tpd modules)	70 (for 3000 tpd) (initially 1000 tpd with a cost of $25 million including fuel user conversion)	Contracts signed and site preparation complete; construction not begun	(Same as East Bridgewater, Mass.)
NEW YORK						
Albany City and 10 nearby communities; Smith & Mahoney (designer); Aenco, Inc. (processing plant operator); N.Y. State (steam plant owner/operator)	Shredding, magnetic separation, burning RDF in semi-suspension stoker-grate boiler, nonferrous recovery from boiler ash	RDF, ferrous metals, steam for urban heating and cooling, nonferrous metals	750 tons per shift	26.6 (11.6 processing plant; 15 steam plant)	Processing plant operational; steam generating facility expected to begin shakedown in Spring 1981	Patrick Mahoney Smith & Mahoney 79 N. Pearl St. Albany, N.Y. 12207
Glen Cove City (owner/operator); William F. Cosulich and Ernest F.W. Frank (designer)	Mass burning in stoker-fired furnace with vacuum filtered sewage sludge	Steam for electricity for use at sewage plant	225	34 (22 for mass burning unit; 12 for sewage plant)	Sewage plant and incinerator unit under construction	Joseph P. Hurley Dir. of Public Works City Hall Bridge St. Glen Cove, N.Y. 11542
Hempstead Town; Hempstead Resources Recovery Corp. (subsidiary of Parsons & Whittemore, Inc.) (owner/operator)	Hydrasposal™ (wet pulping), magnetic and other separation, burning of RDF in air-swept spout spreader stoker boilers	Electricity from utility-owned turbine generators; color-sorted glass, aluminum, ferrous metals	2000 (150 tph)	130	Temporarily shut down by joint agreement between Town and HRRC until EPA establishes uniform standards for testing of dioxins	Jim McGiffin Acting Plant Manager Hempstead Resources Recovery Corp. P.O. Box 5010 Roosevelt Field Station Garden City East, N.Y. 11530
Monroe County County (owner); Raytheon Service Co. (designer/operator); CH_2M Hill (owner's representative)	Shredding, air classification, froth flotation, magnetic and other separation	RDF for use by utility as supplemental boiler fuel; ferrous metals, nonferrous metals, glass	2000	62.2	Recovery facility in shakedown; RDF receiving/storage facility construction to be completed in Summer 1981	Howard Christensen Dir. of Solid Waste Dept. of Public Works 110 Colfax St. Rochester, N.Y. 14606
Niagara Falls Hooker Energy Corp. (Hooker Chemicals & Plastics Corp.) (owner/operator)	Shredding; magnetic separation; burning shredded refuse	Steam and electricity for use by company complex; ferrous metals	2200	74 (approx.)	In shakedown; full operation expected by Summer 1981	James Green Media Relations Hooker Chemical MPO Box 728 Niagara Falls, N.Y. 14302

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
NEW YORK (cont'd)						
New York (Betts Avenue Incinerator) City	Mass burning in refractory furnace	Steam for heating and processes in-plant and adjacent City garages	1000 (present throughput 500)	5-waste heat boiler (1965); 24-modifications (1980)	Electrostatic precipitator being installed and other modifications being made, expect to resume 1000 tpd operation upon completion	Paul Gregory Assistant Planner Dept. of Sanitation Office of Resource Recovery 51 Chambers St., Rm. 830 New York, N.Y. 10007
Oceanside Township of Hempstead (owner/operator) Charles R. Velzy (designer)	Mass burning in waterwall furnace	Steam (60,000 lbs./hr.) used in-plant for electricity and salt-water conversion process	750	9	Operational	Al Albanese Supt., Sanitation Township of Hempstead 1600 Merrick Rd. Merrick, N.Y. 11566
Westchester County (Peekskill) County & 34 municipalities; UOP, Inc.	Mass burning in waterwall furnace	Steam and electricity for sale to utility	1500	100	Negotiations underway with UOP, Inc., for full-service contract; construction expected to begin mid to late 1981 with operations in Jan. 1984.	Edward K. Davies Deputy Commissioner, Solid Waste Mgmt. Rm. 522, County Office Bldg. White Plains, N.Y. 10601
OHIO						
Akron City; Glaus, Pyle, Schomer, Burns & DeHaven (designer); Teledyne National (operator)	Shredding, air classification, magnetic separation, burning RDF in semi-suspension stoker-grate boiler	Steam for urban and industrial heating and cooling, ferrous metals	1000	55	Operational; modifications planned for 1981 to bring plant to design capacity including elimination of air classifier system	Dave Chapman 203 Municipal Bldg. 166 South High St. Akron, Ohio 44308
Columbus City; Alden E. Stilson Assoc. (designer)	Shredding, magnetic separation, burning of shredded refuse with supplemental coal in semi-suspension stoker-grate boiler to produce steam and generate electricity	Electricity for city customers	2000 (3000 peak)	152	Under construction; operation expected in late 1982	Henry Bell, Supt. Div. of Electricity 50 W. Gay St. Columbus, Ohio 43215
OREGON						
Lane County County; Allis-Chalmers Corp. (designer); Western Waste Corp. (operator)	Shredding, air classification, magnetic separation	RDF, ferrous metals	500	2.1	Plant repaired and modified after 1979 explosion; testing began Spring 1980; County negotiating with Allis-Chalmers regarding acceptance of plant as operational; high ash content may necessitate modifications before acceptance	Mike Turner Adm. Analyst Lane County Solid Waste Mgmt. Div. Environmental Mgmt. Dept. 125 East 8th St. Eugene, Ore. 97401
PENNSYLVANIA						
Harrisburg City; Gannett, Fleming, Corddry and Carpenter, Inc. (designer)	Mass burning of MSW and sewage sludge in waterwall furnace, bulky waste shredding (steam driven), magnetic separation	Steam for utility-owned district heating system and for city-owned sludge drying system, ferrous metals	720	8.3	Operational; sludge drying facility in test	Paul W. Bricker Gannett, Fleming, Corddry and Carpenter, Inc. P.O. Box 1963 Harrisburg, Pa. 17105
TENNESSEE						
Crossville City; Environmental Services Corp. (Mfr: Smokatrol; modified by Environmental Control Products, Inc.)	Shredding, mass burning in modular incinerator	Steam	60	1.11	In shakedown	Nelson C. Walker General Manager Environmental Services Corp. P.O. Box 765 Crossville, Tenn. 38555

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
TENNESSEE (cont'd)						
Dyersburg City; Colonial Rubber (Mfr: Consumat)	Mass burning in modular incinerator	Steam	100	2	Operational	Alderman Bob Kirk Colonial Rubber Dyersburg, Tenn. 38024
Gallatin Sumner County; Cities of Gallatin and Hendersonville; Sanders & Thomas, Inc. (designer)	Mass burning in water-wall rotary combustor	Steam for industrial processing and electricity generation	200	8.1	Under construction; start-up expected in August 1981	Jerry H. Metcalf Project Manager P.O. Box 967 Gallatin, Tenn. 37066
Lewisburg City (Mfr: CICO)	Mass burning in modular incinerator	Steam	60	N/A	Operational	John D. Lambert City Manager 505 Ellington Pkwy Route 1 Lewisburg, Tenn. 37091
Nashville Nashville Thermal Transfer Corp; I.C. Thomasson & Assoc., Inc. (designer)	Mass burning in water-wall incinerator	Steam for urban heating and cooling	530 (processing 400)	24.5	Operational	Milton E. Kirkpatrick Exec. V.P. & Gen. Mgr. Nashville Thermal Transfer Corp. 110 First Ave. South Nashville, Tenn. 37201
TEXAS						
Gatesville (Texas Dept. of Corrections) Texas Dept. of Corrections (Mfr: Consumat)	Mass burning in modular incinerator	Steam	7	2	Operational	R.E. Howell Chief, Bldg. & Eng. Mgmt. Construction Div. Texas Dept. of Corrections P.O. Box 99 Huntsville, Texas 77340
Palestine (Beto Unit, Texas Dept. of Corrections) Texas Dept. of Corrections (Mfr: Consumat)	Mass burning in modular incinerator	Steam	28	3	Under construction; operation expected in Summer 1981	(same as Gatesville, Texas)
VIRGINIA						
Hampton City; NASA Langley Research Center; U.S. Air Force at Langley Field; J.M. Kenith Co. (designer/builder)	Mass burning in water-wall furnace	Steam for use by NASA Langley Research Center	200	10.3	Operational	Frank H. Miller, Jr. Dir. of Public Works Hampton, Va. 23669
Newport News (Ft. Eustis) U.S. Army (Mfr: Consumat)	Mass burning in modular incinerator	Steam	40	1.4	Construction complete and initial testing conducted; full operation expected in April 1981	Chris Wenk Area Engineer Southern Va. Area Office P.O. Drawer B Ft. Eustis, Va. 23604
Norfolk (U.S. Naval Station) U.S. Navy (owner); Navy Public Works Center (operator); Metcalf & Eddy, Inc. (designer)	Mass burning in water-wall furnace	Steam for use by Naval Station	360 (two boilers operated alternately)	2.2	Operational	Richard Eitel Head, Utilities Dept. Navy Public Works Center Norfolk, Va. 23511
Portsmouth (Norfolk Naval Shipyard) U.S. Navy (owner); Public Works Dept., Norfolk Naval Shipyard (operator)	Mass burning in water-wall furnace	Steam for use by facilities at Naval Shipyard	160 (two 80-tpd boilers, operated alternately)	4.5	Operational	Jim Bailey NAVFAC ENG COM Environmental Quality Div. Norfolk, Va. 23511

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
VIRGINIA (cont'd)						
Portsmouth (Southeastern Tidewater Energy Project) Southeastern Public Service Authority of Va.; Henningson, Durham & Richardson (architect/engineer); Day & Zimmerman (construction manager); Norfolk Naval Shipyard	Shredding, air classification, magnetic and other separation	RDF for burning in power plant at Naval Shipyard, ferrous and nonferrous metals	2000	70	Concept has changed to RDF production instead of steam/electricity generation; contracts in approval process; operation projected for late 1986	Durwood S. Curling Executive Director Southeastern Tidewater Energy Project 16 Koger Executive Center, Suite 129 Norfolk, Va. 23502
Salem City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	100	1.9	Operational	William Paxton, Jr. City Manager P.O. Box 869 Salem, Va. 24153
WASHINGTON						
Tacoma City (owner/operator); Boeing Engineering (designer)	Shredding, air classification, magnetic separation	RDF, ferrous metals	500	2.5	Operational; running periodically to produce RDF for test burning	Bill Larson, Proj. Mgr. Refuse Utility 740 St. Helens Ave. Rm. 304 Tacoma, Wash. 98402
WISCONSIN						
Madison City and M.L. Smith Environmental (designer); Madison Gas & Electric Co. (RDF user)	Shredding, magnetic separation, trommel screening, secondary shredding	RDF burned by utility for electricity generation; ferrous metals	400 (max) (250 being processed)	2.5	Operational	Robert Vetter Div. of Engineering Rm. 115, City-County Bldg. Madison, Wis. 53709
Milwaukee City; Americology Div. of American Can Co. (owner/operator); Bechtel, Inc. (designer)	Shredding, air classification, magnetic separation (nonferrous and glassy aggregate separation not in use)	RDF for use by utility, bundled paper and corrugated, ferrous metals	1600	18 (plus 4.2 at Wis. Electric Power Co.)	Reached design capacity in April 1980; maintained until Sept. 1980; temporarily shut down pending negotiations with WEPCO on problems of boiler slagging on coal only, aggravated when co-firing RDF.	George Mallan Dir. of Operations & Marketing Americology American Can Co. GOP #8 Greenwich, Conn. 06830
Waukesha City; Donohue & Assoc. (incinerator designer); Sanders & Thomas, Inc. (heat recovery system designer)	Mass burning in refractory furnace	Steam for local industry and sewage treatment plant	175 (design) (120 burning)	Incinerator 1.7 (1971) Heat recovery system 3.9 (1979)	Incinerator operating since 1971, waste heat recovery boiler added in 1979; operating and sending steam to local industry; sewage plant under construction and will be ready for steam in July 1981	Rodney Vanden Noven Dir. of Public Works 201 Delafield St. Waukesha, Wis. 53186

Methane Recovery from Landfills

Location and Major Participants	Output or Gas Produced: Million ft³/day	Capital Costs ($ millions)	Status	Source
CALIFORNIA				
Azusa Azusa Land Reclamation Co. (wholly owned subsidiary of the Southwestern Portland Cement Co.)	Low Btu gas	N/A	Operational	Ralph Rule Southwestern Portland Cement Co. 3055 Wilshire Blvd. Los Angeles, Calif. 90010
Carson Watson Biogas Systems; SCS Engineers	Medium Btu gas to power generators, producing electricity for sale to utility	N/A	Collection system complete; operations expected in Feb. 1982	Joseph V. Seruto, Pres. Watson Biogas Systems 22010 S. Wilmington Ave. Suite 207 Carson, Calif. 90745
Duarte Watson Biogas Systems; Lockman and Assoc.	Medium Btu gas to power generators, producing electricity for sale to utility	N/A	Collection system under construction; operations expected in Dec. 1981	(Same as Carson, Calif.)
Martinez Getty Synthetic Fuels, Inc.	Medium Btu gas	N/A	Operations expected in late 1981	Frederick C. Rice Getty Synthetic Fuels, Inc. 2750 Signal Parkway Signal Hill, Calif. 90806
Monterey Park Getty Synthetic Fuels, Inc.; Operating Industries, Inc.; Southern California Gas Co.	High Btu gas; 4.0	N/A	Operational	(Same as Martinez, Calif.)
Mountain View City of Mountain View; EPA; Pacific Gas & Electric Co.; Dept. of Energy	High Btu gas; 0.5	.85	Demonstration plant; currently operating and producing 0.25 MMSCFD of treated gas with a HHV of 750-800 Btu/SCF	Max Blanchet Pacific Gas & Electric Co. 245 Market St. San Francisco, Calif. 94106
Palos Verdes Getty Synthetic Fuels, Inc.; Los Angeles County Sanitation Dist.; Southern California Gas Co.	High Btu Gas; .75	N/A	Operational	(Same as Martinez, Calif.)
San Fernando Getty Synthetic Fuels, Inc.	Medium Btu gas	N/A	Operations expected in late 1981	(Same as Martinez, Calif.)
San Leandro Getty Synthetic Fuels, Inc.; Oakland Scavenger Co.	Medium Btu gas	N/A	Operations expected in April 1981	(Same as Martinez, Calif.)
Sun Valley (Sheldon-Arleta Landfill Gas Recovery Project) City of Los Angeles Departments of Public Works and Water & Power	Low Btu gas; 2.8	2.5	Compressor station undergoing equipment modifications; operations expected to resume in Spring 1981	Mike Miller Sanitary Engineer L.A. Bureau of Sanitation Room 1410, City Hall East Los Angeles, Calif. 90012
Wilmington Watson Biogas Systems, Inc.; SCS Engineers	1.5	N/A	Operational	(Same as Carson, Calif.)
ILLINOIS				
Calumet City Getty Synthetic Fuels, Inc.; Waste Management, Inc.; Natural Gas Pipeline Co. of America	High Btu gas; 2.5	N/A	Operational	(Same as Martinez, Calif.)
NEW JERSEY				
Cinnaminson Sanitary Landfill, Inc.; Public Service Electric & Gas Co.; Hoeganaes Corp.	Medium Btu gas (600 Btu/SCF); 1 (Used in-plant by Hoeganaes Corp.)	N/A	Operational; modifications planned to improve service reliability and add other customers	Tom Sharp Public Service Electric & Gas Co. of N.J. 80 Park Plaza T-16A Newark, N.J. 07101

Location and Major Participants	Output or Gas Produced: Million ft³/day	Capital Costs ($ millions)	Status	Source
NEW YORK				
Staten Island (Fresh Kills Landfill) Brooklyn Union Gas Co., Inc.; New York City Office of Resource Recovery & Waste Disposal; N.Y. State Energy Research & Development Authority; U.S. Dept. of Energy; Leonard S. Wegman, Inc.	0.05	.33	Burner test of landfill gas in scaled-down furnace completed; tests being conducted Feb.-Aug. 1981 using raw landfill gas in internal combustion engine generator to produce 100 Kw of electricity	Anthony Giuliani Brooklyn Union Gas Co., Inc. 195 Montague St. Brooklyn, N.Y. 11202
Staten Island (Fresh Kills Landfill) Getty Synthetic Fuels, Inc.; City of New York; Brooklyn Union Gas Co.	High Btu gas	N/A	Operations expected to begin in early 1982	(Same as Martinez, Calif.)
NORTH CAROLINA				
Winston-Salem City	Medium Btu gas (burned to generate electricity to power sewage treatment plant)	Less than $25,000 for wells and pipeline	Operations expected to begin in Spring 1981	Charles D. Malone Supervisor Archie Elledge Wastewater Treatment Plant 2801 Griffith Rd. Winston-Salem, N.C. 27103

Planned Resource Recovery Facilities

ALABAMA
- Huntsville (Redstone Arsenal)

CALIFORNIA
- Alameda
- Berkeley
- Eureka
- Gardena
- Long Beach
- North Santa Clara County
- Richmond
- San Diego
- San Francisco

CONNECTICUT
- Hartford
- South/Central Connecticut

FLORIDA
- Hillsborough County

IOWA
- Dubuque

KENTUCKY
- Paducah

MARYLAND
- Prince Georges County

MASSACHUSETTS
- Boston
- North Andover
- Springfield

MINNESOTA
- St. Paul

MISSOURI
- Kansas City
- St. Louis
- Springfield

NEW YORK
- Babylon, Huntington, Islip (Multi-Town Authority)
- Broome County
- Cattaraugus County
- New York
- Onondaga County
- Oyster Bay

OHIO
- Cincinnati
- Cuyahoga County
- Toledo

OKLAHOMA
- Oklahoma City
- Tulsa

OREGON
- Portland

RHODE ISLAND
- State of Rhode Island

TENNESSEE
- Nashville
- Memphis

VERMONT
- Burlington

VIRGINIA
- Petersburg

WISCONSIN
- Appleton

NOTE

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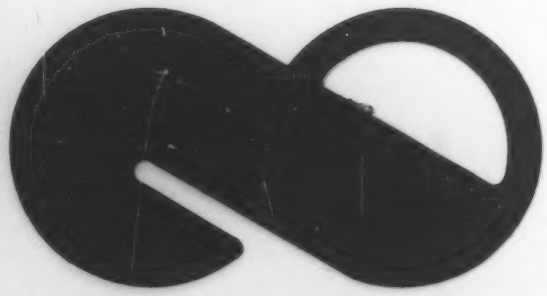

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National Center for Resource Recovery, Inc.

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With Ronald Reagan's budget-cutting axe slashing innumerable federal programs and his conservative appointees administering regulatory agencies, what is to become of federal involvement in resource recovery? A veteran government-watcher offers his views on the prospects.

35 Choosing and Implementing Resource Recovery Systems

Local planners, faced with the variety of options available in resource recovery systems, often have to make difficult decisions with insufficient guidance. To provide more information and assist communities facing resource recovery decisions, the University of Michigan's Institute for Social Research is studying the local decision-making and implementation process in about 40 localities where resource recovery systems are either operating or under construction. Preliminary findings are presented here.

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The resource recovery profile in this issue turns from producers of recovered materials to a consumer—Southeast Paper Manufacturing Co. in Dublin, Ga., which recycles about 600 tons per day of old newspapers to make new newsprint.

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The Case for Mass Burning . . . Prepared Fuels

The two major approaches to energy recovery from municipal solid waste are mass burning of unprocessed refuse to produce steam, and processing the refuse into a prepared fuel before burning. Advocates of each approach advance arguments for their methods of energy recovery.

Federal Resource Recovery Programs and the Reagan Administration

By RUSSELL A. DAWSON

There is no question that 1981 promises to be a memorable year. Government watchers from all over, especially those with an environmental regulatory bent, are keeping their eyes on Washington, D.C., hoping to have a front-row seat for the fireworks display many are sure is not far off. The momentum of "government future" is about to collide with the inertia of "government past," they say, and the results could be explosive.

The election of Ronald Reagan and the advent of the first Republican Senate in a quarter century portend dramatic changes in the way government will function in this country for the next few years. Perhaps longer.

Public frustration with what was perceived as government that was too big and leadership that was out of sync with the economic realities of the 1980s has brought to power the most conservative administration in recent memory. That conservative government is committed to making marked changes in any number of government agencies and programs.

At the top of its list of priorities is reform of regulatory government, and chief among its targets is the U.S. Environmental Protection Agency. The Reagan administration wants to cut the waste, trim the fat and relieve what it sees as the burdens that have been placed on the shoulders of America's economy by this agency. Or so its spokesmen say.

"The momentum of 'government future' is about to collide with the inertia of 'government past.'"

Russell A. Dawson is a managing editor with Business Publishers, Inc., Silver Spring, Md., which publishes Solid Waste Report.

Reagan's EPA administrator, Anne McGill Gorsuch, is a conservative Colorado utility attorney with roots in the "Sagebrush Rebellion" of the West; her mentor is rebellion leader James Watt, President Reagan's Secretary of the Interior and a man whose philosophy of resource management is anathema to environmentalists.

Reagan has proposed a federal budget for fiscal year 1982 that would make significant cuts in environmental programs, including solid waste management and resource recovery. In fact, the programs most important to promoters of resource recovery and other alternatives to the land disposal of solid wastes are all slated to be liquidated by the new government.

Federal entities with the most significant roles in offering past incentives to resource recovery are being eyed for possible restructuring—most notably, EPA and the Department of Energy.

Career bureaucrats at both agencies are bracing for the worst. If Reagan campaign rhetoric is to provide the basis for administration environmental and energy policy, the new government is considering the complete reorganization of EPA and the elimination of DOE.

There is some evidence on hand that the administration is about to take the first steps in that direction. EPA's Gorsuch is said to be planning significant staff cutbacks at her agency, and DOE Secretary James Edwards is on record as supporting the ultimate plan to dismantle his department.

EPA could be the first major battleground in any reorganization effort. Very little about Gorsuch's plans for the agency is known, since she consistently has refused to be interviewed or to

answer reporters' inquiries. She also chose to isolate herself from most of EPA's interim management during the period prior to her confirmation by the Senate. (At this writing, Gorsuch had just taken office.)

Several major national news organs, led by the *Detroit Free Press*, however, have reported that she favors cutting EPA's permanent staff of 13,000 by 10 percent over the next two years. That would put some 1300 bureaucrats and regulators out on the street.

"EPA's Gorsuch is said to be planning significant staff cutbacks at her agency."

Almost all of EPA's top management could be in trouble, too, according to those same news reports. Gorsuch is said to be considering a plan to get rid of most of the agency's 300 or so highest ranking officials because she suspects them of being either environmental zealots or bureaucrats too committed to current agency policies and programs. A spokesman for Gorsuch denies those reports, but top career bureaucrats within the agency are uneasy about their futures and will remain so until the new administrator begins to communicate with them.

Regulatory Cycle

Some observers suggest that regulatory government is cyclical. That is, there is a distinct cycle to regulation. It begins at the local level as a site-specific solution to a particular problem, builds and broadens in importance in state government and peaks as a major federal program.

At some point following the regulatory peak, however, the public will begin to tire of regulation and to resent its perceived cost. The solution, critics suggest at that point, is "regulatory reform." Return this program to the states where it can be handled with more sensitivity and less idealistic passion, the sentiment goes.

To date, government efforts to regulate and control the management of solid wastes seem to be following this regulatory cycle.

Traditionally, solid waste management has always been a local matter. For decades, the philosophy of waste management was something akin to "out of sight . . . out of mind." Put wastes in the ground and forget about them.

Dumping of garbage indiscriminately led to the realization some time ago, however, that out of sight was really not out of mind. At least not forever. Open dumps were found to cause pollution of surface and ground water, explosion and fire hazards, vector problems and a host of other aesthetic and public health ills.

The more progressive states began to step in and take a hand in siting landfills, prescribing sound engineering practices for disposal of solid waste, and regulating the solid waste management industry. In addition, some states began to explore resource recovery as a solution to the ills of landfilling.

Environmental awareness on the national scale was at its peak in 1976 when the 94th Congress enacted the Resource Conservation and Recovery Act (RCRA). To many, the passage of RCRA was the ultimate in progressive solid waste management. A federal program designed to help the states build and improve their own solid waste management programs, is how RCRA was described.

At the heart of RCRA were to be millions of federal dollars for use by the states to design and implement comprehensive solid waste management programs, including resource recovery, under the watchful eye of EPA.

Cutting Back

In part because of its actual dollar cost, and in part because so many people think all government has gotten too big, there is growing sentiment today to stop the federal monster in its tracks. Many government programs put in place during the past 15 years are now undergoing the scrutiny of dedicated reformers who would like nothing better than to cut them to the quick.

Solid waste management and resource recovery under RCRA are no exceptions. Those programs appear to have peaked at the federal level and we are beginning to hear the calls for reform. Many top administration officials want to see government involvement in most aspects of solid waste management returned to the states, or the private sector, "where they really belong."

Ronald Reagan is the man who is leading all the budget cutting efforts. He is ultimately the one who will authorize any return of solid waste management responsibility to the states.

At the White house, Reagan has a blueprint for undertaking the effort to reform solid waste management regulations, among others. It is a two-volume epic on managing government prepared for the President last fall by the Heritage Foundation—a conservative think-tank.

The first volume, a 3000-page master plan entitled "Mandate for Change: Policy Management in a Conservative Administration," outlines a detailed scheme for significantly cutting back all government at the federal level. A companion volume, "Agenda for Progress: Examining Federal Spending," is a budget study prepared by university scholars, economists and policy analysts. Both documents address government in a broad sense.

Through a few direct quotes on solid waste and interpretation of the general thrust of these primers on government, however, it is clear where the conservatives want to point the Reagan administration. Matters of solid waste management are "purely local" in nature, and "can be handled perfectly well by local governments," the Heritage Foundation scholars said.

The case for a major federal role in regulating solid waste management has not been persuasive since solid waste is not, by definition, a general problem the way air and water pollutants, for example, are, they concluded. There may be some room for a federal presence, but not much of one, the reports suggested. EPA could, perhaps, act as a clearinghouse for solid waste management information and technology, "but its direct regulatory functions should be eliminated."

In both reports, solid waste management as an issue is addressed as an ele-

Trend in Federal Spending for Solid Waste Planning and Resource Recovery
(Dollar amounts shown in millions)

	1980			1981			1982		
Section	Authorized	President's Request	Approved	Authorized	President's Request	Approved	Authorized	Carter Request	Reagan Request
2006(a)	$ 70.0	$19.5	$ 41.6	$ 80.0	$ 73.0	$ 83.4	$ 80.0	$ 57.1	$ 47.6
2006(b)			3.4		5.0	5.0		6.6	0.7
4008(a)(1)	20.0	10.0	10.0	15.0	8.0	8.0	20.0	6.0	0
4008(a)(2)(C)	10.0	13.9	10.0	10.0	10.0	4.0	10.0	6.6	0
4008(a)(3)(A)	—	—	—	4.0	0	0	4.0	0	0
4008(e)(2)	—	—	—	1.5	0	0	1.5	0	0
4008(f)(2)	—	—	—	8.0	0	0	8.0	0	0
RCRA Totals	$163.95	$62.05	$ 80.2	$175.0	$121.0	$125.5	$185.0	$111.4	$ 89.3
Totals, including research and supplementals		$70.3	$100.3		$145.4	$150.2		$143.3	$120.3

Explanation:

Section 2006(a)—Funds authorized for general administration of RCRA programs.
Section 2006(b)—Funds authorized for use under the RCRA technical assistance panels program.
Section 4008(a)(1)—Federal assistance for planning and implementation of state solid waste management plans.
Section 4008(a)(2)(C)—Grants for solid and hazardous waste management, resource recovery and resource conservation.
Section 4008(a)(3)(A)—Grants to states for waste-to-energy feasibility studies.
Section 4008(e)(2)—Special communities grants for solid waste disposal facilities projects.
Section 4008(f)(2)—Grants to municipalities for waste-to-energy feasibility studies.

ment in sections dealing with questions of natural resources and the environment. The author of these sections, Gordon Jones, was a member of the Senate Republican Policy Committee at the time.

"The bulk of expenditures now being made for natural resources and environmental protection are unnecessary," Jones asserted. "Through the elimination of those programs which do not involve third-party costs (or at least returning them to the states for administration), substantial savings can be achieved. Furthermore, the application of economic incentives and constraints, such as users' fees and effluent taxes, will increase efficiency, while at the same time reducing federal spending."

Major Programs Out

It was on the basis of this conservative philosophy that Reagan administration budget cutters took aim at a number of well-established solid waste programs when they prepared the fiscal year 1982 federal budget. Funding for four major programs at EPA and DOE would be virtually eliminated if Congress supports the belt-tightening measures without change. All directly affect resource recovery.

The Reagan team intends to "fund only those programs which meet our most critical national environmental goals," Acting EPA Administrator Walter Barber explained when his agency's revised budget proposal was released.

Those programs destined for elimination through funding cuts include DOE's loan guarantees and price support loans to aid in the commercialization of municipal solid waste-to-energy technology; EPA-administered funding for state solid waste program planning; funding for resource recovery projects under President Carter's Urban Policy; and the technical assistance panels program for non-hazardous solid waste operations created by the Resource Conservation and Recovery Act.

Although DOE's urban waste-to-energy research and development program would be supported to the tune of $9.1 million in FY '82 under the revised Reagan budget, the $220-million appropriated last year by Congress for assisting in development of commercial-scale waste-to-energy plants under the Energy Security Act would be rescinded. The President's thinking here is that the technology for waste-to-energy conversion is already available and the actual cost-effectiveness of the concept should be determined by market pressures. "Further federal involvement is simply not warranted when compared to other programs," one administration official said.

Federal Programs

As for the EPA programs, the Reagan proposal calls for the elimination of funding for comprehensive state solid waste management planning as mandated by Subtitle D of RCRA. In FY '81, EPA awarded $8 million in state planning grants. President Carter had requested another $6 million for FY '82 grants.

Among the important programs funded under these grants, in addition to general planning, is the RCRA-mandated nationwide inventory of open dumps. Resource recovery, recycling and other alternatives to land disposal are also elements in most comprehensive state plans. Thus, the future of these activities will be affected by any decision to cut back on funding.

Another program on its way out under the Reagan budget proposal is EPA's Urban Policy grants program which awarded "seed" money for resource recovery planning. The agency's plans to spend more than $4 million to finish work in support of more than 60 feasibility studies on resource recovery projects, affecting as many as 46 million people in 37 states, would be eliminated.

In addition, Reagan proposes dropping the $1.1 million the Carter administration had requested for the efforts of EPA's technical assistance panels in FY '82. The TA panels program, as it is known, assists municipalities and others to exchange technical information on various aspects of solid waste management, including resource recovery.

Staff positions at EPA headquarters and in the 10 regional offices for overseeing both the TA panels program and funding Urban Policy grants for resource recovery feasibility studies are all slated to be abolished.

Coping With A Bad Situation

With all of these proposed cuts hanging over their heads, officials at EPA and DOE who are responsible for resource recovery and other solid waste management programs are trying to cope with what is, at best, a very bad situation.

EPA has developed and will soon implement a package of guidance material for its regional administrators which takes into account Reagan administration plans to eliminate the agency's request for $6 million in FY '82 funding for state comprehensive planning grants. The agency recommends that top priority among regional solid waste officials should be the review and approval of state programs under RCRA's Subtitle D. Second priority should be the continuation of state efforts to evaluate land disposal facilities for inclusion on EPA's nationwide survey of open dumps.

"President Reagan has a blueprint for reforming solid waste management regulations."

Already, EPA solid waste program officials in the agency's regional offices are in the midst of reviewing a wave of state solid waste management plans developed with Subtitle D grants. Jim Michael, of the Office of Solid Waste's (OSW) state programs branch in Washington, said that 27 states have adopted comprehensive solid waste plans using their own administrative procedures and submitted them to EPA for review and approval. All address resource recovery issues. And more are on the way.

The impact of proposed cuts in comprehensive state planning grants in uncertain at this point. Program managers at OSW predict the results will be mixed.

Those states that historically have been leaders in solid waste management will most likely continue to develop and implement effective plans, whether the federal government pays the bills or not. States such as California, Connecticut and others that took steps to regulate solid waste disposal and to promote resource recovery long before Congress enacted RCRA see the planning process as a worthwhile exercise with benefits far outweighing costs.

On the other hand, however, a number of states will almost certainly adopt the attitude of "no federal money, no planning," Michael acknowledged. States lacking their own solid waste management laws and regulatory frameworks will probably halt efforts to put comprehensive plans in place once the federal dollars are cut off.

At DOE, meanwhile, things are in a state of flux. Programs are in limbo because officials in the Office of Energy from Municipal Waste (OEMW) really have no idea what their program will look like a few months from now.

It is clear that earlier OEMW plans to hand out millions of dollars in price support loans, loan guarantees and other incentives to help commercialize waste-to-energy technology have been quashed. A department-wide order to cut staffing makes it impossible for OEMW to hire new employees.

The office is moving ahead with plans to spend some $9.1 million next year on waste-to-energy research and development projects. OEMW's research program has the approval of the Reagan administration for fiscal 1982. The President did request $5.1 million be cut from OEMW's FY '81 R&D budget, but recent action in the House of Representatives suggests this money will be deferred for a year, rather than rescinded; thus, DOE could have as much as $14.2 million on hand for waste-to-energy R&D work in 1982.

Of course, the big question is how much money, if any, OEMW will have to spend in support of waste-to-energy commercialization projects. Under the Energy Security Act, Congress appropriated $220 million last year for this work.

President Reagan has requested that all of this money be rescinded, and it appears he will get most of what he wants. In early April, the Interior Subcommittee of the House Committee on Appropriations, chaired by Rep. Sidney Yates (D-Ill.), agreed to rescind all but $23 million that would go to cover work on a handful of projects already approved for support by DOE before the rescission request was received.

State Responses

To hear it from actual executives of state solid waste management programs, the future seems very bleak. Both the National Governors' Association (NGA) and the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) are on re-

cord predicting the cuts that have been proposed could have disastrous impacts.

RCRA is essentially a state-oriented law, NGA's Environment Subcommittee pointed out in a position paper last spring. The success of RCRA will be determined largely by the states' willingness and capability to implement programs of their own. "In order to encourage states to develop such programs and to assure that states will have the necessary resources to implement such programs, federal technical and financial assistance must continue for at least the next five years."

The panel, headed by Norman Nosenchuck of New York State's Division of Solid Waste, predicted a situation bordering on chaos. "The majority of states are heavily dependent upon RCRA funding for continued operation of state solid waste management programs," it said. "The states cannot bear the cost of administering federally mandated and encouraged programs without substantial amounts of federal financial and technical assistance."

That seems to be the real rub among state officials. On the one hand, they say, federal law requires them to undertake aggressive new solid waste management programs; while on the other, the federal government is not willing to help pay the cost of these expensive undertakings.

Without adequate funding, NGA pointed out, states will be unable to attract and retain the skilled staffs necessary to devise and implement effective programs. Some states could be forced to abandon RCRA programs altogether without federal help, the report asserted.

"The federal government has a major responsibility and obligation to assist the states in solving our national solid and hazardous waste problems," NGA concluded. Congress must provide sufficient funds to the states under RCRA to permit them to carry out the intent of the act. "Continued funding of state programs must be provided on a long-term basis."

Many of these sentiments were echoed in a report to ASTSWMO in Washington, D.C., Jan. 13, 1981, by that group's Landfill Disposal Committee. That report focused on the impact of budget cuts on the states' abilities to conduct and complete the inventory of open dumps. The outcome of that inventory will have a significant impact on the future of resource recovery, deemed by EPA for years to be the most desirable alternative to landfilling.

Positive results of the open dump inventory would be short-lived, the ASTSWMO committee concluded, if Subtitle D funds were eliminated in the future. The inventory will not be completed beyond its initial stage, and many qualified solid waste management control staffers at the state level will have to be released. Such steps would lead to a "disastrous reduction" in state-level solid waste management programs. The committee urged EPA to provide "vigorous support" for the inventory by fully allocating authorized funds under RCRA.

Legal Twist

Despite all the bad news that is in the air these days regarding the future of federal solid waste management and resource recovery programs, however, there remains a glimmer of hope. Supporters of these programs note an ironic legal twist related to the statutory language of RCRA that could save the day.

When Congress enacted substantive amendments to RCRA last fall, it was aware of Carter administration efforts at the time to phase out Subtitle D state planning grants over a five-year period. Consequently, it included new protective language in the Solid Waste Disposal Act Amendments of 1980 which require that funding continue to flow both to Subtitle D planning activities by the states and to the technical assistance panels.

Specifically, the amended language requires that 20 percent of all general authorization funds appropriated under Section 2006(a) of the act, or $5 million, whichever is less, be earmarked for the technical assistance panels. In addition, Congress approved new language that requires that at least 25 percent of all funds appropriated under the act, up to the amount authorized by Section 4008(a) (1), be used only to support state, regional, local and interstate agencies under Subtitle D.

Turned into real dollars, this language translates literally to mean EPA

States with Solid Waste Management Plans

The shaded states have adopted—or were about to adopt—solid waste management plans as of May 1, 1981. Other areas with plans not shown on the map are Puerto Rico, U.S. Virgin Islands, American Samoa and Guam.

would have a minimum of $5 million for its technical assistance panels program and $20 million for state comprehensive solid waste planning support during fiscal year 1982—quite different from what the Reagan administration has in mind.

This situation poses a dilemma for both Congress and the Reagan administration. It also sets the stage for what could become a free-for-all involving Reagan budget cutters and Congressmen and others who don't want to cut back spending for solid waste management and resource recovery programs at the state level.

Already, the administration has requested that legislation be introduced that would amend RCRA to alter language mandating that funds go to the technical assistance panels. A similar proposal is expected to be forwarded with respect to minimum support of Subtitle D state planning activities.

No one is sure, at this point, whether Congress will go along with either request.

Clearly, Democrats in the House of Representatives are reluctant to cut back on any key environmental programs enacted during the past decade. Many fear any attempt to subject RCRA, with its controversial hazardous waste management provisions, to substantive amendments of any kind this year. Since Democrats control the House, passage of such amendments this year may be very difficult.

Things could be a bit easier in the Senate, where Republicans represent the majority. But even there, members with strong environmental credentials hold key chairmanships and could block efforts to amend RCRA in any way. Active support for RCRA came from the likes of Sen. Robert Stafford (R-Vt.), chairman of the Environment and Public Works Committee, and Sen. John Chafee (R-R.I.), chairman of that panel's Subcommittee on Environmen-

EPA Project Summaries—Resource Recovery Urban Grant Program

Project Grantee	EPA Region	Service Area	EPA Funding As of 10/1/80
City of Claremont, N.H.	I	65,000	$283,200
New Britain, Conn.	I	83,000	77,000
Rhode Island Solid Waste Management Corporation	I	1,000,000	525,900
Rutland Regional Planning Commission, Rutland, Vt.	I	56,000	379,400
Commonwealth of Massachusetts			
—Worcester	I	355,621	213,000
—Springfield	I	414,980	188,000
Connecticut Resources Recovery Authority	I	650,900	725,000
Newark, N.J.	II	380,000	50,000
Puerto Rico Solid Waste Management Authority	II	—	49,600
Hackensack Meadowlands Development Commission	II	1,000,000	73,100
Government of the U.S. Virgin Islands	II	100,500	208,900
Port Authority of New York and New Jersey	II	3,000,000	927,200
City of New York	II	7,500,000	713,800
City of Utica, N.Y.	II	100,000	539,800
Westchester County, N.Y.	II	—	60,100
Monroe County, N.Y.	II	750,000	79,500
Mercer County Improvement Authority	II	325,000	479,000
City and County of Camden, N.J.	II	500,000	495,900
Town of Brookhaven, N.Y.	II	350,000	56,200
Northeast Maryland Solid Waste Disposal Authority	III	670,000	637,100
West Virginia Resource Recovery-Solid Waste Disposal Authority	III	382,496	203,200
Southeastern Public Service Authority of Virginia	III	820,000	322,400
District of Columbia	III	702,000	447,600
Howard County, Md.	III	—	55,600
La Grange, Ga.	IV	50,000	315,900
Floyd County, Ga.	IV	80,000	219,000
Savannah, Ga.	IV	192,000	208,900
Escambia County, Fla.	IV	225,400	307,900
Hillsborough County, Fla.	IV	652,000	461,200
Region "M" COG Fayetteville, N.C.	IV	212,000	232,700
Bell County, Ky., Garbage & Refuse Disposal District	IV	33,000	329,500
Broward County, Fla.	IV	950,000	244,800

tal Pollution, in years past.

Given the strong support for RCRA in its present form in both houses, it is quite possible that Congress could refuse to act on the administration's request for amendments or the President could decide not to pursue them. Reagan already has submitted his FY '82 budget request for RCRA programs, however, and there is no money for either state solid waste planning grants or the technical assistance panels. Appropriations Committees in the House and Senate have already started scrutinizing the request.

Should Congress proceed to enact the President's budget request without approving RCRA amendments that would change the statutory formula for allocating funds, EPA would be placed in a situation whereby it would be in technical violation of RCRA. It would not be distributing appropriated funds the way the act requires.

The legality of such a situation, and ways to remedy it, are already being considered and debated among Congressional staffers, EPA solid waste officials and various interest groups that are directly involved with solid waste management issues. It is quite possible, although no one is admitting it at this point, that interest groups with strong ties to the states could take the administration to court and demand that the states and technical assistance panels get the share of appropriations they are entitled to under existing RCRA language.

Other Legislation

Aside from the upcoming battles over the federal budget, which are a perennial event in Washington despite their added significance this year, Congress also has before it a few other bills important to the resource recovery community. A couple are given better than even chances of at least receiving serious

EPA Project Summaries—Resource Recovery Urban Grant Program
(continued)

Project Grantee	EPA Region	Service Area	EPA Funding As of 10/1/80
City of Daytona Beach, Fla.	IV	150,000	331,200
Jefferson County, Ala.	IV	155,000	245,100
City of Chicago, Ill.	V	3,000,000	308,200
City of Rockford, Ill.	V	150,000	49,200
City of St. Paul, Minn.	V	310,000	324,000
City of Indianapolis, Ind.	V	775,000	379,100
City of Detroit, Mich.	V	1,500,000	317,500
Genesee County Drain Commission, Flint, Mich.	V	450,000	437,400
West Michigan Regional Planning Commission	V	540,000	429,700
Cuyahoga County, Ohio	V	1,600,000	598,800
Montgomery County, Ohio	V	585,000	417,600
Toledo Metropolitan Area Council of Governments	V	585,000	116,600
Wisconsin Solid Waste Recycling Authority	V	255,000	365,000
Regional Planning Commission for Jefferson, Orleans, St. Bernard, St. Tammany Parishes, La.	VI	1,100,000	685,000
City of Waco, Texas	VI	103,000	98,400
Tarrant County, Texas, Planning Department	VI	825,750	274,600
Bi-State Development Agency, St. Louis, Mo.	VII	2,400,000	335,500
Black Hawk County, Iowa, Solid Waste Management Commission	VII	137,000	235,400
Kansas City, Mo.	VII	1,300,000	336,500
Eagle County, Colo.	VIII	13,000	185,000
Wasatch Front Regional Council	VIII	800,000	342,500
Sanitation Districts of Los Angeles County, Calif.	IX	7,000,000	75,000
City of Long Beach, Calif.	IX	500,000	458,500
County of Kauai, Hawaii	IX	40,000	201,500
City of Berkeley, Calif.	IX	150,000	425,000
City and County of San Francisco Solid Waste Management Program	IX	660,000	465,000
City of Los Angeles, Calif.	IX	2,900,000	357,600
King County, Wash.	X	1,200,000	775,800
Metropolitan Service District, Portland, Ore.	X	900,000	554,100

consideration by this Congress, or perhaps the next.

The first, S.750, sponsored by conservative Sen. Malcolm Wallop (R-Wyo.), would amend the Internal Revenue Code of 1954 to provide nonrefundable tax credits for investments in qualified industrial energy efficiency and fuel conversion projects. It would offer specific incentives to purchasers of recycling and waste-to-energy equipment.

The bill has a reasonable chance for consideration sometime in the next year or two because of its unusual bipartisan support. Included among its cosponsors are conservatives John Tower (R-Tex.), Thad Cochran (R-Miss.) and Alfonse D'Amato (R-N.Y.); and liberals Edward Kennedy (D-Mass.), John Chaffee (R-R.I.) and Charles Percy (R-Ill.).

"The Reagan legacy, whatever it will be, has yet to be born."

The second, S.709, represents the latest in a long series of attempts to impose a national system of deposits on the sale of beverage containers. Such a bill would have a marked impact on resource recovery, should it pass, for it would encourage the separation for recovery of glass bottles and metal cans from the waste stream prior to the point of disposal.

Despite the fact bottle bills similar to S.709 have been introduced to every session of Congress for the past decade, this time the measure has at least a fighting chance of being considered. The reason is its sponsors—Sens. Bob Packwood (R-Ore.) and Mark Hatfield (R-Ore.)—have power in Congress. Packwood chairs the Senate Commerce Committee, which has jurisdiction over the bill, and Hatfield is chairman of the Appropriations Committee, which has influence over everything.

Realistically, however, neither bill is expected to go anywhere before this fall, at the earliest. Both must build up steam before attempting to negotiate the House and Senate. This will be difficult to do during a summer when the order of the day will be the President's economic package.

Battle Lines

Budget cuts will be the linchpin of the economic debate. Battle lines have already been drawn with respect to future spending for solid waste management and resource recovery during the Reagan years.

On one side, the administration is committed to significant cuts in federal spending and regulatory authority. It hopes those programs can be returned to state and local governments.

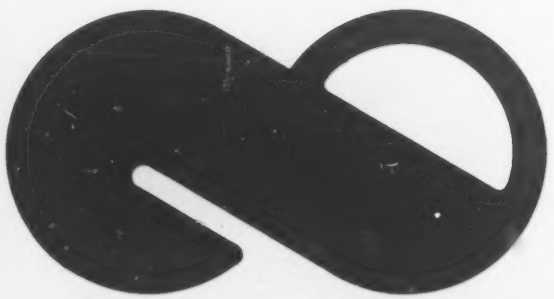
On the other side, a coalition of groups representing environmentalists, state and local governments and related interests is forming to lobby for continued federal support of solid waste planning and resource recovery.

To make his proposed spending cuts in waste management stick, President Reagan may have to convince Congress to amend RCRA, in light of existing statutory language. An agreement to permit such revisions on the part of key House and Senate members overseeing that law, however, could open the door for other changes that they do not want. Thus, the administration faces a hard sell that would yield cuts of approximately $10 million, at the most. Many observers say it is not worth the fight. That remains to be seen.

Where things go from here is anyone's guess. It will be the political compromises of those on Capitol Hill and in the Executive Branch that will ultimately decide the fate of current solid waste and resource recovery programs.

Meanwhile, however, program planners at EPA and DOE, waste management officials in the states and cities, and other interest groups must sit back and wait. The Reagan legacy, whatever it will be, has yet to be born. ∞

Special Issue
Resource Recovery Activities



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National Center for Resource Recovery, Inc.

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A complete listing of NCRR publications, 1971 through September 1981.

Resource Recovery Activities

This listing of resource recovery facilities in the United States, prepared and distributed by the National Center for Resource Recovery, Inc., since 1974, is broken down into three segments: (1) recovery of materials and energy from processed municipal solid waste (MSW) or burning of unprocessed MSW; (2) recovery of methane gas from MSW landfills; and (3) jurisdictions which report being committed to undertake one or more forms of resource recovery. Not included is the growing number of communities which are conducting source separation programs and/or magnetically separating ferrous metals from mixed refuse. With this issue, facilities in Canada are included in the listing.

Although every effort has been made to make this report as complete and current as possible, the dynamics of resource recovery are such that project status can change at any time. For clarification or additional information on a specific facility, we suggest that you write directly to the source given for that listing.

The National Center is grateful for the contributions and cooperation of each project representative, as well as that of the U.S. Department of Energy, U.S. Environmental Protection Agency, and local and state governments.

Materials and Energy Recovery Facilities

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
ARKANSAS						
Batesville City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	50	1.2	Operational	Jim Shirrell, Mayor Municipal Bldg. 170 S. Forth St. Batesville, Ark. 75201
Blytheville City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	70 (to be processed)	N/A	Temporarily closed; awaiting delivery of new incinerators	Tom Little, Mayor City Hall Blytheville, Ark. 72315
North Little Rock City; U.S. Recycle Corp. (Mfr: Consumat)	Mass burning in modular incinerator	Steam	100	1.45	Operational	Gene Green U.S. Recycle Corp. P.O. Box 7561 Little Rock, Ark. 72217
Osceola City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	50	1.1	Operational	R.E. Prewitt, Mayor City Hall Osceola, Ark. 72370
CONNECTICUT						
Bridgeport Conn. Resources Recovery Auth.; Occidental Petroleum Corp. and Combustion Equipment Assoc. (designer/operator), Greater Bridgeport Regional Solid Waste Commission	Shredding, air classification, magnetic separation, Eco-Fuel® II production process (aluminum and glass recovery equipment not in use)	Eco-Fuel® II (powdered fuel) for use in utility boiler, ferrous metals	1800	53	Temporarily closed due to CEA's financial difficulties; Occidental has taken over facility and met with CRRA and municipalities on re-opening; decision on plant's future expected this fall	Wanda A. Rickerby Public Affairs Coordinator Conn. Resources Recovery Authority 179 Allyn St. Hartford, Conn. 06103

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
CONNECTICUT (cont'd)						
Windham Town of Windham (Mfr: Consumat)	Mass burning in modular incinerator	Steam	108	4.125	Under construction; start-up expected in November 1981	Louise Guarnaccia First Selectman Town of Windham Town Office, 979 Main St. Willimantic, Conn. 06226
DELAWARE						
Wilmington Delaware Solid Waste Authority; EPA; Raytheon Service Co. (designer)	Shredding, air classification, magnetic separation, froth flotation, other mechanical separation; aerobic digestion	Ferrous and nonferrous metals, glass, RDF, humus	1000 tpd municipal solid waste co-processed with 350 tpd of 20% solids digested sewage sludge	71.3	Under construction; start-up expected in late 1982	Pasquale S. Canzano Chief Engineer Delaware Solid Waste Authority P.O. Box 455 Dover, Del. 19901
FLORIDA						
Dade County (Dade County Solid Waste Resource Recovery Plant) County; Parsons & Whittemore, Inc. (designer/operator)	Hydrasposal™ (wet pulping), magnetic and other mechanical separation	Steam for utility to produce electricity, aluminum, ferrous metals	3000	165	Construction almost complete; startup depends upon resolution of contract dispute between P&W and County	Dennis Carter, Asst. County Manager Room 911 Dade County Courthouse 73 W. Flagler St. Miami, Fla. 33130
Dade County (Agripost Composting Plant) County; Agripost, Inc. (owner/operator/designer)	Composting	Soil conditioner	400	8.5	Contract signed; facility under design (pilot plant)	(Same as previous listing)
Jacksonville (Naval Air Station) U.S. Navy	Shredding, magnetic separation, trommel screening, mass burning in modular incinerator	Steam	40 design; 20 actual	2.8	Operational	R.P. LeVasseur Dir. of Utilities P.O. Box 5, Code 187 Naval Air Station Jacksonville, Fla. 32212
Lakeland City (operator and joint owner with Orlando Utility Commission); C.T. Main, Inc. (power plant designer); Horner & Shifrin, Inc. (waste processing plant designer)	Shredding, magnetic separation, burning RDF with coal	Steam to produce electricity for use by City of Lakeland and Orlando Utility Commission, ferrous metals	300	5 (for waste processing plant)	Under construction; start-up of waste processing plant expected in early 1982	Claude Hiers Supt. of Industrial Engin. & Business Affairs Box 368 Lakeland, Fla. 33802
Orange County (Walt Disney World) U.S. Dept. of Energy, Idaho Operations Office; Reedy Creek Utilities Co.	Slagging pyrolysis incineration (Andco-Torrax)	High temperature water for heating and cooling	100	15	Under construction; completion expected in March 1982 (demonstration plant)	Carl P. Gertz Project Manager U.S. Dept. of Energy 550 Second St. Idaho Falls, Idaho 83401
Pinellas County County; Florida Power Corp.; UOP, Inc.	Mass burning, mechanical separation of metals after burning	Electricity, ferrous and nonferrous metals	2000	160	Construction began Aug. 1980; operational in 3 years	Don F. Acenbrack Director, Solid Waste Mgmt. Dept. Pinellas County 315 Court St. Clearwater, Fla. 33516

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
FLORIDA (cont'd)						
Pompano Beach Waste Management, Inc.; U.S. Dep't. of Energy; Jacobs Engineering Co. (designer)	Shredding, air classification, magnetic and other mechanical separation, anaerobic digestion of air classified light fraction with sewage sludge	Methane gas, carbon dioxide	50-100	3.65	Operational (demonstration plant)	Ted Sjoberg Dir. of Engineering Waste Management, Inc. 900 Jorie Blvd. Oak Brook, Ill. 60521
HAWAII						
Honolulu City and County of Honolulu; Combustion Engineering, Inc./Amfac, Inc.	Shredding, magnetic separation, trommel and other screening, burning RDF in spreader stoker boilers for generation of electricity	Ferrous metals,electricity for utility	1800	90	Negotiations underway to review impact of possible plant site relocation; construction expected to begin in early 1982	Frank Doyle, Chief Div. of Refuse Collection & Disposal Dept. of Public Works City & County of Honolulu Honolulu, Hawaii 96813
IDAHO						
Burley Cassia County (Mfr: Consumat)	Mass burning in modular incinerator	Steam	50	1.5	Operation expected by end of 1981	Norman Dayley County Commissioner Cassia County Court House Burley, Idaho 83318
ILLINOIS						
Chicago (Northwest Incinerator) City; Metcalf & Eddy, Inc. (designer)	Mass burning in water-wall incinerators, ferrous recovery from ash (intermittent)	Steam for process use on-site and by Brach Candy Co., ferrous metals	1600	23	Operational	Emil Nigro Supervising Engineer Dept. of Streets & Sanitation Room 700, City Hall Chicago, Ill. 60602
Chicago (Southwest Supplementary Fuel Processing Facility) City; Ralph M. Parsons Co. and Consoer, Townsend & Assoc. (designer)	Shredding, air classification, magnetic separation	RDF for use by utility; ferrous metals	1000	19	Off-stream to review experience and evaluate future operations; decisions pending	(Same as previous listing)
IOWA						
Ames City; Gibbs, Hill, Durham & Richardson, Inc. (designer)	Baling waste paper, shredding, magnetic separation, air classification, screening, other mechanical separation	RDF for use by utility, baled paper, ferrous metals, aluminum, other nonferrous metals	200 (50 tph)	6.3	Operational	Arnold Chantland, Dir. Dept. of Public Works City Hall 5th and Kellog St. Ames, Iowa 50010
LOUISIANA						
New Orleans City; Waste Management, Inc. (owner/operator); National Center for Resource Recovery, Inc. (designer/implementer)	Shredding, air classification, magnetic and other mechanical separation	Ferrous metals, aluminum, glass	700	9.1	Shredding/landfilling and ferrous recovery operational; aluminum and glass recovery in shakedown	Clifford Scineaux, Dir. Dept. of Sanitation City Hall New Orleans, La. 70112

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
MAINE						
Auburn City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	200	3.97	Operational	Robert Belz Public Works Auburn City Hall 45 Spring St. Auburn, Maine 04210
MARYLAND						
Baltimore City, EPA	Shredding, pyrolysis in rotary kiln, steam production	Steam for use in heating/air conditioning steam loop by utility	600	30.1	Temporarily shut down for modifications	Ed May Baltimore City Pyrolysis Plant 1800 Annapolis Rd. Baltimore, Md. 21230
Baltimore County County; Maryland Environmental Service; Teledyne National (designer/operator)	Shredding, air classification, magnetic and other mechanical separation, pelletizing	RDF, ferrous metals, glass	1200	8.4	Operational; recovering ferrous metals and producing shredded and pelletized RDF; glass recovery system being developed and refined; aluminum recovery not in use	Kenneth Cramer Teledyne National Padonia Centre, Ste. 401 30 E. Padonia Rd. Timonium, Md. 21093
MASSACHUSETTS						
Braintree City (owner/operator); Camp, Dresser & McKee Inc. (designer)	Mass burning in waterwall furnace	Steam (half of steam produced used by Art & Leather Co.)	250	2.8	Operational	Edward Courchene, Supt. Braintree Thermal Waste Reduction Center Ivory Street Braintree, Mass. 02184
East Bridgewater City of Brockton and nearby towns; Combustion Equipment Assoc; East Bridgewater Assoc.	Shredding; air classification; magnetic separation; other mechanical separation and production of Eco-Fuel® II	Eco-Fuel® II for industrial boiler; ferrous metals	550 being processed	10-12	Plant has served as pilot operation for Eco-Fuel® II production and recently for Eco-Fuel briquet production; currently closed due to CEA's financial difficulties; operations continuing as sanitary landfill	M. G. Magoulas Corp. Vice Pres., Engineering Combustion Equipment Assoc. 555 Madison Ave. New York, N.Y. 10022
Haverhill & Lawrence Refuse Fuels, Inc. (owner); BE&C Engineers, Inc. (Boeing subsidiary) (design & construction); Cities of Haverhill & Lawrence	Shredding, magnetic separation, trommel screening at recovery facility in Haverhill; burning RDF for cogeneration of steam and electricity in Lawrence	Steam and electricity for industrial use; surplus electricity sold to utility	1300	78	Groundbreaking scheduled for Sept. 1981, with full operation in 3 years	James E. Ricci, Vice Pres. Refuse Fuels, Inc. P.O. Box 187 Bradford, Mass. 01830
North Andover UOP, Inc.,; MITRE Corp.; Mass. Bureau of Solid Waste Disposal, Dept. of Environmental Affairs; participating communities	Mass burning in waterwall furnace, electricity generation	Electricity for sale to utility, steam	1500	74	Service agreements being signed wth participating communities; groundbreaking expected by early 1982	John F. Albis Project Mgr. 128 Main St. North Andover, Mass. 01845

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
MASSACHUSETTS (cont'd)						
Pittsfield City, Vicon Recovery Assoc.	Mass burning in modular incinerator	Steam	240	6.2	Operational	Joseph J. Domas, Jr., Pres. Vicon Recovery Assoc. P.O. Box 100, Butler Center Butler, N.J. 07405
Saugus Thirteen communities including Saugus and part of northern Boston; RESCO (owner/operator)	Mass burning in water-wall furnaces, magnetic separation	Steam for electrical generation and industrial use, ferrous metals	1200	50	Operational	John M. Kehoe, Jr. Wheelabrator-Frye, Inc. Liberty Lane Hampton, N.H. 03842
MICHIGAN						
Detroit City; Combustion Engineering, Inc./Waste Resources Corp.	Shredding, air classification, magnetic separation, burning RDF in dedicated boilers	Steam for use in Detroit Edison's existing steam loop and electricity during off-peak periods, ferrous metals	3000	125	Negotiating with Combustion Engineering, Inc./Waste Resources Corp. prior to contract signing; preparing a revenue bond issue to finance the facility	Michael Brinker Dept. of Public Works City of Detroit City-County Bldg., Rm. 513 Detroit, Mich. 48226
Genesee Township Township (Mfr: Consumat)	Mass burning in modular incinerator	Steam	100	2	Operation interrupted due to lack of steam customers; negotiating with prospective customer	Hanumanthaiya Marur, P.E. Engineer 1202 S. Grand Traverse Flint, Mich. 48503
MINNESOTA						
Collegeville St. John's University; Basic Environmental Engineering (designer)	Mass burning in modular incinerator	Steam	70	2.5	Under construction; start-up expected in Oct. 1981	Fr. Gordon Tavis St. John's University Collegeville, Minn. 56321
Duluth Western Lake Superior Sanitary District (owner/operator); Consoer, Townsend & Assoc. (designer)	Shredding, magnetic separation, air classification, secondary shredding, fluidized bed incineration of RDF and sludge	RDF, ferrous metals, steam for heating and cooling of plant and to run process equipment	400 of MSW; 340 of 20% solids sewage sludge	19	In shakedown; full operation expected in late 1981	John Klaers Western Lake Superior Sanitary Dist. 27th Ave. West & The Waterfront Duluth, Minn. 55806
Redwing City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	72	2.5	Construction scheduled to begin in Fall 1981 with operation in Fall 1982	Dean Massette Council Administrator Box 34 Redwing, Minn. 55066
MISSOURI						
Ft. Leonard Wood U.S. Army (Mfr: Environmental Control Technology)	Mass burning in modular incinerator	Steam	75	3.3 (approx.)	Under construction; start-up expected in Jan. 1982	Robert Fuerst Facility Engineers Building 2200 Ft. Leonard Wood, Mo. 65473

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
MONTANA						
Livingston Park County; WIDJAC Corp. (Mfr: Consumat)	Mass burning in modular incinerator	Steam	40	2.3	Under construction; shakedown expected in May 1982	Ken Spalding County Commissioner City-County Bldg. 414 E. Calendar St. Livingston, Mont. 59047
NEW HAMPSHIRE						
Durham (Lamprey Regional Solid Waste Cooperative) Members of cooperative: 12 towns, 1 city (Mfr: Consumat)	Mass burning in modular incinerator	Steam	108	3.3	Operational	Malcolm Chase, Chairman Lamprey Regional Solid Waste Cooperative 13-15 Newmarket Rd. Durham, N.H. 03824
Groveton City; Groveton Paper Mill, Inc. (Mfr: Environmental Control Products)	Mass burning in modular incinerator	Steam	24	N/A	Operational	Rick Coville Groveton Paper Mill, Inc. Groveton, N.H. 03582
Portsmouth City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	200	6	Under construction; operation expected in July 1982	Calvin Canney City Manager 126 Daniel St. Portsmouth, N.H. 03801
NEW YORK						
Albany City and 10 nearby communities; Smith & Mahoney (designer); Aenco, Inc. (processing plant operator); N.Y. State (steam plant owner/operator)	Shredding, magnetic separation, burning RDF in semi-suspension stoker-grate boiler, nonferrous recovery from boiler ash	RDF, ferrous metals, steam for urban heating and cooling, nonferrous metals	750 tons per shift	26.6 (11.6 processing plant; 15 steam plant)	Processing plant operational; steam generating facility in shakedown	Patrick Mahoney Smith & Mahoney 79 N. Pearl St. Albany, N.Y. 12207
Glen Cove City (owner/operator); William F. Cosulich and Ernest F.W. Frank (designer)	Mass burning in stoker-fired furnace with centrifuged sewage sludge	Steam for electricity for use at sewage plant and incinerator	225	34 (22 for mass burning unit; 12 for sewage plant)	Sewage plant in operaton; incinerator unit under construction	Joseph P. Hurley Dir. of Public Works City Hall Bridge St. Glen Cove, N.Y. 11542
Hempstead Town; Hempstead Resources Recovery Corp. (subsidiary of Parsons & Whittemore, Inc.) (owner/operator)	Hydrasposal™ (wet pulping), magnetic and other separation, burning of RDF in air-swept spout spreader stoker boilers	Electricity from utility-owned turbine generators, color-sorted glass, aluminum, ferrous metals	2000 (150 tph)	130	Temporarily shut down by joint agreement between Town and HRRC until EPA establishes uniform standards or guidelines for testing of dioxins	Jim McGiffin Acting Plant Manager Hempstead Resources Recovery Corp. P.O. Box 5010 Roosevelt Field Station Garden City East, N.Y. 11530

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
NEW YORK (cont'd)						
Monroe County County (owner); Raytheon Service Co. (designer/operator); CH_2M Hill (owner's representative)	Shredding, air classification, froth flotation, magnetic and other separation	RDF for use by utility as supplemental boiler fuel, ferrous metals, nonferrous metals, glass	2000	62.2	Recovery facility in shakedown; RDF receiving/storage facility complete; test-burning RDF	Howard Christensen Dir. of Solid Waste Dept. of Public Works 110 Colfax St. Rochester, N.Y. 14606
Niagara Falls Hooker Energy Corp. (Hooker Chemicals & Plastics Corp.) (owner/operator)	Shredding; magnetic separation; burning shredded refuse	Steam and electricity for use by company complex; ferrous metals	2200	90+	In shakedown; full operation expected in late 1981	James Green Media Relations Hooker Chemical MPO Box 728 Niagara Falls, N.Y. 14302
New York (Betts Avenue Incinerator) City	Mass burning in refractory furnace	Steam for heating and processes in-plant and adjacent City garages	1000 (present throughput 500)	5-waste heat boiler (1965); 24-modifications (1980)	Electrostatic precipitator being installed and other modifications being made; expect to resume 1000 tpd operation upon completion	Paul Gregory Assistant Planner Dept. of Sanitation Office of Resource Recovery 51 Chambers St., Rm. 830 New York, N.Y. 10007
Oceanside Township of Hempstead (owner/operator) Charles R. Velzy (designer)	Mass burning in waterwall furnace	Steam (60,000 lbs./hr.) used in-plant for electricity and salt-water conversion process	750	9	Operational	Ali Albanese Supt., Sanitation Township of Hempstead 1600 Merrick Rd. Merrick, N.Y. 11566
Westchester County (Peekskill) County & 34 municipalities; Wheelabrator-Frye, Inc.	Mass burning in waterwall furnace, ferrous metal recovery from ash	Steam and electricity for sale to utility, ferrous metals	1890	165	Full-service contract signed with Wheelabrator-Frye in June 1981; construction expected to begin in late 1981 or early 1982 with operations in late 1984	Edward K. Davies Deputy Commissioner, Solid Waste Mgmt. Rm. 522, County Office Bldg. White Plains, N.Y. 10601
OHIO						
Akron City; Tricil Ltd.	Shredding, magnetic separation, burning RDF in semi-suspension stoker-grate boiler	Steam for urban and industrial heating and cooling, ferrous metals	1000	80	Refuse processing system temporarily shut down for modification of materials handling system; expected to be on-line in Fall 1982; steam being generated by natural gas to supply customers	Dave Chapman 203 Municipal Bldg. 166 South High St. Akron, Ohio 44308
Columbus City; Alden E. Stilson Assoc. (designer)	Shredding, magnetic separation, burning of shredded refuse with supplemental coal in semi-suspension stoker-grate boiler to produce steam and generate electricity	Electricity for city customers	2000 (3000 peak)	154.2	Under construction; operation expected in late 1982	Henry Bell, Supt. Div. of Electricity 50 W. Gay St. Columbus, Ohio 43215

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
OREGON						
Lane County County; Allis-Chalmers Corp. (designer); Western Waste Corp. (operator)	Shredding, air classification, magnetic separation	RDF, ferrous metals	500	2.1	Plant has been accepted by county following cash settlement from Allis-Chalmers; plant is "in mothballs" pending decision to operate; high ash problem has not been corrected; county is negotiating for markets and a burn test	Mike Turner, Adm. Analyst Lane County Solid Waste Mgmt. Div. Environmental Mgmt. Dept. 125 East 8th St. Eugene, Ore. 97401
PENNSYLVANIA						
Harrisburg City; Gannett, Fleming, Corddry and Carpenter, Inc. (designer)	Mass burning of MSW and sewage sludge in waterwall furnace, bulky waste shredding (steam driven), magnetic separation	Steam for utility-owned district heating system and for city-owned sludge drying system, ferrous metals	720	8.3	Operational; sludge drying facility in test	Paul W. Bricker Gannett, Fleming, Corddry and Carpenter, Inc. P.O. Box 1963 Harrisburg, Pa. 17105
RHODE ISLAND						
Warwick R.I. Solid Waste Mgmt. Corp.; Widmer & Ernst	Mass burning, cogeneration of steam and electricity	Steam for state institutional complex, electricity for sale to utility	1200	100	Contract negotiations underway; site named by RISWMC in May 1981; construction expected to begin in mid-1982 with operation in mid-1985	Susan J. Baldyga Public Information Coordinator R.I. Solid Waste Mgmt. Corp. 39 Pike St. Providence, R.I. 02903
TENNESSEE						
Crossville City; Environmental Services Corp. (Mfr: Smokatrol; modified by Environmental Control Products, Inc.)	Shredding, mass burning in modular incinerator	Steam	60	1.11	Operational	Nelson C. Walker General Manager Environmental Services Corp. P.O. Box 765 Crossville, Tenn. 38555
Dyersburg City; Colonial Rubber Works (Mfr: Consumat)	Mass burning in modular incinerator	Steam	100	2	Operational	Alderman Bob Kirk Colonial Rubber Works, Inc. Dyersburg, Tenn. 38024
Gallatin Sumner County; Cities of Gallatin and Hendersonville; Sanders & Thomas, Inc. (designer)	Mass burning in waterwall rotary combustor	Steam for industrial processing and electricity generation	200	8.1	Under construction; start-up expected in Nov. 1981	Jerry H. Metcalf Project Manager P.O. Box 967 Gallatin, Tenn. 37066
Lewisburg City (Mfr: CICO)	Mass burning in modular incinerator	Steam	60	1.75	Operational	John D. Lambert City Manager 505 Ellington Pkwy. Route 1 Lewisburg, Tenn. 37091

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
TENNESSEE (cont'd)						
Nashville Nashville Thermal Transfer Corp; I.C. Thomasson & Assoc., Inc. (designer)	Mass burning in water-wall incinerator	Steam for urban heating and cooling	530 (processing 400)	24.5	Operational	Milton E. Kirkpatrick Exec. V.P. & Gen. Mgr Nashville Thermal Transfer Corp. 110 First Ave. South Nashville, Tenn. 37201
TEXAS						
Gatesville (Texas Dept. of Corrections) Texas Dept. of Corrections (Mfr: Consumat)	Mass burning in modular incinerator	Steam	7	.2	Operational	R.E. Howell Chief, Bldg. & Eng. Mgmt. Construction Div. Texas Dept. of Corrections P.O. Box 99 Huntsville, Texas 77340
Palestine (Beto Unit, Texas Dept. of Corrections) Texas Dept. of Corrections (Mfr: Consumat)	Mass burning in modular incinerator	Steam	28	.3	Operational	(same as Gatesville, Texas)
VIRGINIA						
Hampton City; NASA Langley Research Center; U.S. Air Force at Langley Field; J.M. Kenith Co. (designer/builder)	Mass burning in water-wall furnace	Steam for use by NASA Langley Research Center	200	10.3	Operational	Frank H. Miller, Jr. Dir. of Public Works Hampton, Va. 23669
Newport News (Ft. Eustis) U.S. Army (Mfr: Consumat)	Mass burning in modular incinerator	Steam	40	1.4	Operational	Chris Wenk Area Engineer Southern Va. Area Office P.O. Drawer B Ft. Eustis, Va. 23604
Norfolk (Norfolk Naval Station) U.S. Navy (owner); Public Works Center, Norfolk Naval Station (operator)	Mass burning in water-wall furnace	Steam for use by facilities at Norfolk Naval Station	360 (two 180-tpd boilers, operated alternately)	2.2 (1967)	Operational	J. R. Bailey Atlantic Div., Code 114 NAV. FAC. ENG. COM. Norfolk, Va. 23511
Portsmouth (Norfolk Naval Shipyard) U.S. Navy (owner); Public Works Dept., Norfolk Naval Shipyard (operator)	Mass burning in water-wall furnace	Steam for use by facilities at Naval Shipyard	160 (two 80-tpd boilers, operated alternately)	4.5	Operational	(Same as Norfolk, Va.)

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
VIRGINIA (cont'd)						
Portsmouth (Southeastern Tidewater Energy Project) Southeastern Public Service Authority of Va.; Henningson, Durham & Richardson (architect/engineer); Day & Zimmerman (construction manager); Norfolk Naval Shipyard	Shredding, air classification, magnetic and other separation	RDF for burning in power plant at Naval Shipyard, ferrous and nonferrous metals	2000	70	Concept has changed to RDF production instead of steam/electricity generation; contracts in approval process; operation projected for late 1986	Durwood S. Curling Executive Director Southeastern Tidewater Energy Project 16 Koger Executive Center, Suite 129 Norfolk, Va. 23502
Salem City (Mfr: Consumat)	Mass burning in modular incinerator	Steam	100	1.9	Operational	William Paxton, Jr. City Manager P.O. Box 869 Salem, Va. 24153
WASHINGTON						
Tacoma City (owner/operator); Boeing Engineering (designer)	Shredding, air classification, magnetic separation	RDF, ferrous metals	500	2.5	Operational; running periodically to produce RDF for test burning	Bill Larson, Proj. Mgr. Refuse Utility 740 St. Helens Ave. Rm. 304 Tacoma, Wash. 98402
WISCONSIN						
Madison City and M.L. Smith Environmental (designer); Madison Gas & Electric Co. (RDF user)	Shredding, magnetic separation, trommel screening, secondary shredding	RDF burned by utility for electricity generation; ferrous metals	400 (max) (250 being processed)	2.5	Operational	Robert Vetter Div. of Engineering Rm. 115, City-County Bldg. Madison, Wis. 53709
Milwaukee City; Americology Div. of American Can Co. (owner/operator); Bechtel, Inc. (designer)	Shredding, air classification, magnetic separation (nonferrous and glassy aggregate separation not in use)	RDF for use by utility, bundled paper and corrugated, ferrous metals	1600	18 (plus 4.2 at Wis. Electric Power Co.)	Reached design capacity in April 1980; maintained until Sept. 1980; temporarily shut down pending negotiations with WEPCO on problems of boiler slagging on coal only, aggravated when co-firing RDF.	George Mallan Dir. of Operations & Marketing Americology American Can Co. GOP #8 Greenwich, Conn. 06830
Waukesha City; Donohue & Assoc. (incinerator designer); Sanders & Thomas, Inc. (heat recovery system designer)	Mass burning in refractory furnace	Steam for local industry and sewage treatment plant	175 (design) (120 burning)	Incinerator 1.7 (1971) Heat recovery system 3.9 (1979)	Incinerator operating since 1971; waste heat recovery boiler added in 1979; operating and sending steam to local industry and sewage plant	Rodney Vanden Noven Dir. of Public Works 201 Delafield St. Waukesha, Wis. 53186

Location and Major Participants	Processes	Products	Capacity (tons per day)	Capital Costs ($ millions)	Status	Source
CANADA						
ONTARIO						
Hamilton Regional Municipality of Hamilton-Wentworth (owner); Tricil Ltd. (operator)	Shredding, magnetic separation, burning in dedicated spreader stoker boiler	Ferrous metal, steam	500	9*(1972)	Operational since 1972; 3.2 MW turbine generator is being added and expected to be operating by June 1982	Joseph Kennedy Project Manager Tricil Ltd. 101 Queensway West, Suite 400 Mississauga, Ontario L5B 2P7
Toronto Ontario Ministry of the Environment; Browning-Ferris Industries (operator)	Shredding, air classification, secondary shredding, screening, mass burning in modular incinerator with heat recovery; ferrous cleaning; also transfer operation	Ferrous metal, RDF, compost; hot water for plant heating	Resource recovery—200; transfer facility—600	15*	Operational	Neal R. Alhberg Plant Manager Ontario Centre for Resource Recovery 35 Vanley Crescent Downsview, Ontario M3J 2B7
PRINCE EDWARD ISLAND						
Parkdale Prince Edward Island Energy Corp.; Tricil Ltd.	Mass burning in modular incinerator	Steam	108	8.2*	Start-up expected in Dec. 1982	(Same as Hamilton, Ontario)

*Canadian dollars.

Methane Recovery from Landfills

Location and Major Participants	Output or Gas Produced; Million ft³/day	Capital Costs ($ millions)	Status	Source
CALIFORNIA				
Azusa Azusa Land Reclamation Co. (wholly owned subsidiary of the Southwestern Portland Cement Co.)	Low Btu gas	N/A	Operational	F. T. Sheets III Azusa Land Reclamation Co. 1201 W. Gladstone St. Azusa, Calif. 91702
Carson Watson Biogas Systems; SCS Engineers	Medium Btu gas to power generators, producing electricity for sale to utility	N/A	Collection system complete; operations expected in Feb. 1982	Joseph V. Seruto, Pres. Watson Biogas Systems 22010 S. Wilmington Ave. Suite 207 Carson, Calif. 90745
City of Industry	Medium Btu gas; .5 (approx.)	.45	Operational	Robert Stearns SCS Engineers, Inc. 4014 Long Beach Blvd. Long Beach, Calif. 90807

Location and Major Participants	Output or Gas Produced; Million ft³/day	Capital Costs ($ millions)	Status	Source
CALIFORNIA (cont'd)				
Duarte Watson Biogas Systems; Lockman and Assoc.	Medium Btu gas to power generators, producing electricity for sale to utility	N/A	Collection system under construction; operations expected in Feb. 1982	(Same as Carson, Calif.)
Los Angeles (Bradley East Landfill)	Medium Btu gas; 2.4	N/A	Operational	Hugh A. Walker Director of Marketing Genstar Gas Recovery Systems, Inc. 550 N. Rosemead Blvd. Pasadena, Calif. 91107
Martinez Getty Synthetic Fuels, Inc.	Medium Btu gas	N/A	Operations expected in late 1981	Frederick C. Rice Getty Synthetic Fuels, Inc. 2750 Signal Parkway Signal Hill, Calif. 90806
Monterey Park Getty Synthetic Fuels, Inc.; Operating Industries, Inc.; Southern California Gas Co.	High Btu gas; 4.0	N/A	Operational	(Same as Martinez, Calif.)
Mountain View City of Mountain View; EPA; Pacific Gas & Electric Co.; Dept. of Energy	High Btu gas; 0.3	.85	Demonstration plant; currently operating and producing 0.3 MMSCFD of treated gas with a HHV of 850-950 Btu/SCF; expansion currently under investigation	Max Blanchet Pacific Gas & Electric Co. 245 Market St. San Francisco, Calif. 94106
Palos Verdes Getty Synthetic Fuels, Inc.; Los Angeles County Sanitation Dist.; Southern California Gas Co.	High Btu Gas; .75	N/A	Operational	(Same as Martinez, Calif.)
San Fernando Getty Synthetic Fuels, Inc.	Medium Btu gas	N/A	Operations expected in late 1981	(Same as Martinez, Calif.)
San Leandro Getty Synthetic Fuels, Inc.; Oakland Scavenger Co.	Medium Btu gas	N/A	Operational	(Same as Martinez, Calif.)
Sun Valley **(Sheldon-Arleta Landfill Gas Recovery Project)** City of Los Angeles Departments of Public Works and Water & Power	Low Btu gas; 2.8	2.5	Compressor station undergoing equipment modifications; operations expected to resume in Fall 1981	Mike Miller Sanitary Engineer L.A. Bureau of Sanitation Room 1410, City Hall East Los Angeles, Calif. 90012
Wilmington Watson Biogas Systems, Inc.; SCS Engineers	1.5	N/A	Operational	(Same as Carson, Calif.)
ILLINOIS				
Calumet City Getty Synthetic Fuels, Inc.; Waste Management, Inc.; Natural Gas Pipeline Co. of America	High Btu gas; 2.5	N/A	Operational	(Same as Martinez, Calif.)
MICHIGAN				
Riverview Watson Biogas Systems; SCS Engineers	Medium Btu gas to power generators, producing electricity for sale to utility	N/A	Contracts with city signed; applications for construction permits submitted; utility negotiations proceeding	(Same as Carson, Calif.)

Location and Major Participants	Output or Gas Produced; Million ft³/day	Capital Costs ($ millions)	Status	Source
NEW JERSEY				
Cinnaminson Sanitary Landfill, Inc.; Public Service Electric & Gas Co.; Hoeganaes Corp.	Medium Btu gas (570 Btu/SCF); 1 (Used in-plant by Hoeganaes Corp.)	N/A	Operational; modifications planned to improve service reliability and add other customers	Tom Sharp Public Service Electric & Gas Co. of N.J. 80 Park Plaza T-16A Newark, N.J. 07101
NEW YORK				
Staten Island (Fresh Kills Landfill) Brooklyn Union Gas Co., Inc.; New York City Office of Resource Recovery & Waste Disposal; N.Y. State Energy Research & Development Authority; U.S. Dept. of Energy; Leonard S. Wegman, Inc.	0.05	.33	Test began in Feb. 1981 using raw landfill gas in an internal combustion engine generator to produce 100 Kw of electricity; 2000 hrs. logged on unit as of July 11, 1981	Anthony Giuliani Brooklyn Union Gas Co., Inc. 195 Montague St. Brooklyn, N.Y. 11202
Staten Island (Fresh Kills Landfill) Getty Synthetic Fuels, Inc.; City of New York; Brooklyn Union Gas Co.	High Btu gas	N/A	Operations expected to begin in early 1982	(Sames a Martinez, Calif.)
NORTH CAROLINA				
Winston-Salem City	Medium Btu gas (burned to generate electricity to power sewage treatment plant)	Less than $25,000 for wells and pipeline	Operational	Charles D. Malone Supervisor Archie Elledge Wastewater Treatment Plant 2801 Griffith Rd. Winston-Salem, N.C. 27103

Planned Resource Recovery Facilities

ALABAMA
- Huntsville (Redstone Arsenal)
- Opelika

CALIFORNIA
- Alameda
- Berkeley
- Eureka
- Gardena
- Long Beach
- North Santa Clara County
- Point Richmond
- San Diego
- San Francisco
- Ukiah

CONNECTICUT
- Hartford
- South/Central Connecticut

FLORIDA
- Hillsborough County

GEORGIA
- Savannah

IOWA
- Dubuque

KENTUCKY
- Paducah

MARYLAND
- Prince Georges County

MASSACHUSETTS
- Boston
- Springfield

MINNESOTA
- St. Paul

MISSOURI
- Kansas City
- St. Louis
- Springfield

NEW JERSEY
- Camden County
- Ft. Dix
- Middlesex County
- Ocean County
- Union County

NEW YORK
- Babylon, Huntington, Islip (Multi-Town Authority)
- Broome County
- Cattaraugus County
- New York
- Onondaga County
- Oyster Bay
- Washington County

OHIO
- Cincinnati
- Cuyahoga County
- Toledo

OKLAHOMA
- Oklahoma City
- Tulsa

OREGON
- Marion County
- Portland

TENNESSEE
- Nashville
- Memphis

VERMONT
- Burlington

VIRGINIA
- Petersburg

WISCONSIN
- Appleton

The National Center for Resource Recovery, Inc.

A Bibliography

Since its inception, one mission of the National Center for Resource Recovery has been the preparation and dissemination of information. To this end, a large body of literature has been prepared and/or published by NCRR, much of it in the form of articles, papers and reports. Following is a bibliography of NCRR-prepared literature through September 1981.

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